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BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXII **1900.** **No. 1**

PHYSICAL GEOGRAPHY OF NEW YORK STATE.

BY

RALPH S. TARR.

PART X.—INFLUENCE OF PHYSIOGRAPHIC FEATURES UPON THE INDUSTRIAL DEVELOPMENT OF THE STATE.

THE LUMBERING INDUSTRY.—There are few places in the world in which the environment—climatic and topographic—have not produced an important influence upon human progress. But one would need to look far and wide to find a better illustration of this than is offered by the State of New York. In the main the State consists of a series of plains and much-dissected plateaux, comprised generally of broad valleys and rounded hill-slopes. Semi-mountainous here and there, the surface becomes truly so in two parts only—the Adirondacks and the neighborhood of the Catskills.

These mountains—rugged and rocky—are sparsely settled districts in an otherwise populous State. The unfavorable conditions of soil and topography for a long time discouraged settlement; but recently, on account of the more wide-spread development of the æsthetic sense, those who have leisure have sought those districts because of their varied and picturesque scenery and because of the lower summer temperature which results from their elevation.

The picturesqueness of these mountain districts is partly due to their elevation, as a result of which they have been carved into varied outlines, and partly to the effects of the glacier which has spread over practically the entire State. Moving slowly and irresistibly over the land, the great ice-sheet scoured the hilltops and dragged its load of boulder-clay into the valleys, clogging them here and there, and sometimes transforming them to lakes, sometimes causing the streams to choose new courses, along which they have since dug their channels, carving gorges in the rocks and leaping from layer to layer in cascades, rapids and falls. Thus, by the effect of glaciation, a new beauty has been added to a region already picturesque.

In working upon the hard rocks of the mountains, the glacier has swept off the soil that previously existed, and over large areas has left in its place either bare ledges or a boulder-strewn surface. Neither is the slope too great, nor the climate too rigid, for successful agriculture in most of this mountainous tract; but as a result of the glacial accident the soil is either poor or entirely lacking. Much the same is true concerning the higher hills of the plateau region in southern New York. It has, therefore, not been worth the while to clear off the forests, as has been done elsewhere, so that the hilltops and mountain slopes are still wooded, furnishing a forest reserve long after one would have existed in a more level region. In this respect the Adirondacks and the Catskills resemble northern New England rather than the remainder of New York.

Lumbering, as an industry, is one of the few occupations that are available for those who would dwell among these mountains; for minerals are few and mostly of little value, while building-stones, which might be of use, are too remote from market. Removal of the forests has proceeded so far that little of the primitive growth remains, and even though large sections of the Adirondacks are inaccessible, except on foot, the lumbering operations have extended nearly all over their slopes. This has been rendered possible here, as in Maine, partly by reason of the climate, and partly, once more, by reason of the influence of the glacial period. The cold winter freezes the ponds, swamps and streams, and permits heavy snowfall, which levels over the surface, burying the logs and boulders, thus permitting sledging in the winter, so that supplies may be drawn into the lumber camps and logs be hauled out from the woods. The heavy snows of the steep slopes supply the necessary torrents of spring for the removal of the logs down to saw-mills.

The effect of the glacial period upon this industry is primarily in the formation of lakes, which act as storage reservoirs for the water supply needed by the lumbermen who are driving their logs down stream. Thus a region unfitted for the dense population of an agricultural district is sparsely occupied by those whose business is lumbering. A road map of New York State shows a remarkable blank in the hilly districts of the plateau of Cattaraugus County, (Fig. 1) in the Catskills and the Adirondack.

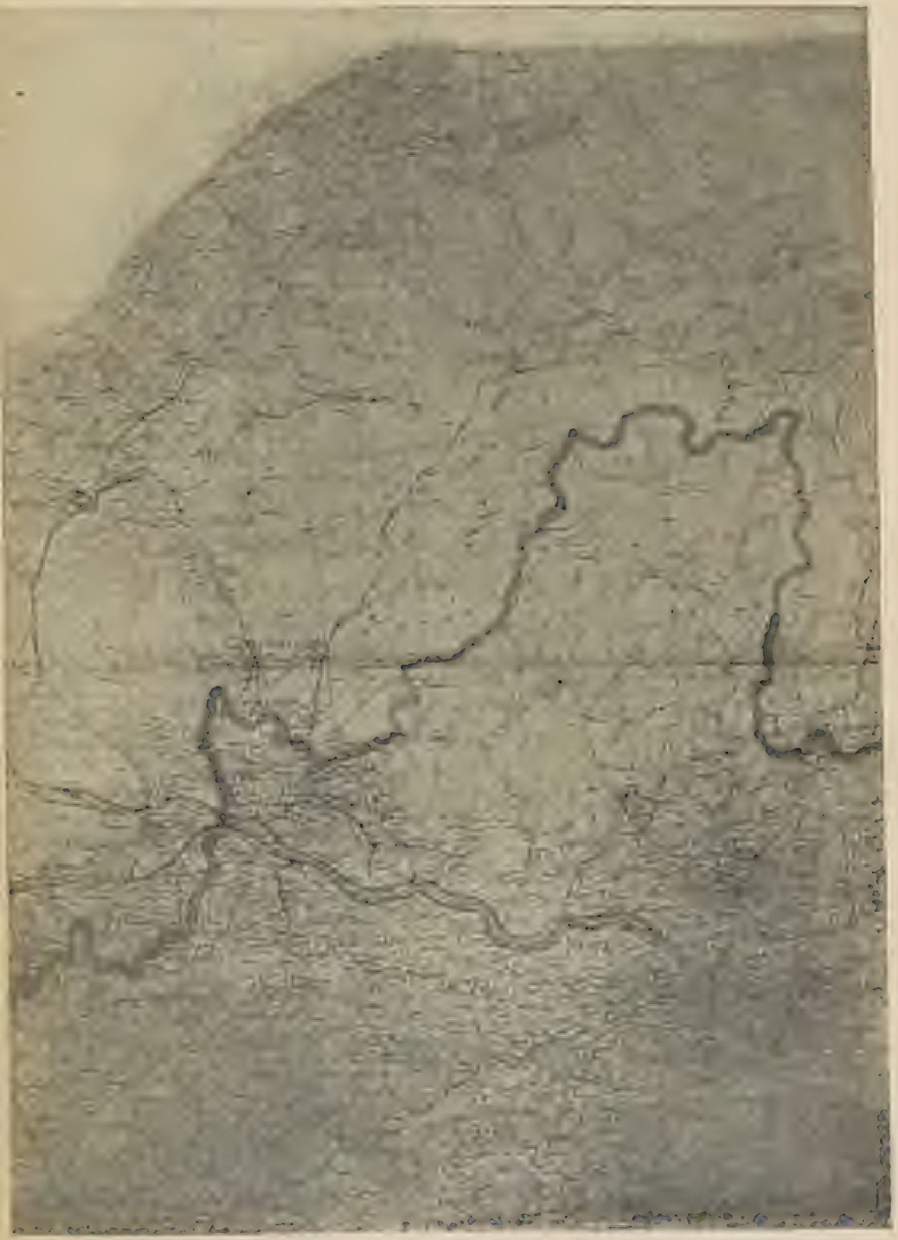

FIG. 1.—ROAD MAP.

The lumbering industry of the mountain districts has naturally had a distinct influence upon the industries of the sections round about. Where hemlock bark is easily accessible, tanneries, and leather work in general, have been possible. Sawmills, lumber mills, paper mills and other industries using timber have naturally developed nearby.

THE AGRICULTURAL INDUSTRY.— The glacial accident has stamped its effects upon the entire State. No doubt before the ice came there was a residual soil caused by rock decay and not unlike that now covering the surface in the more southern States; and no doubt this same kind of soil covered all of New England. This soil was almost entirely swept away, and in its place was set down the present glacial soil, consisting for the most part of a mixture of clay and boulders, here and there of poor quality, but in general strong and favorable to agricultural pursuits. One unacquainted with the explanation, but knowing well the New England and New York region, would scarcely recognize in the two contrasted kinds of soils a single product of ice action. In New England the surface is often so boulder-strewn that it at times seems a wonder that any agriculture should ever have been attempted there; but in New York, outside of the mountainous eastern section, there are so few boulders upon the surface that one rarely sees a stone wall—one of the characteristic features of New England scenery. This difference is due to the kind of rock which the ice found to carry. In New England it bore granite and other hard fragments; in New York, usually softer shales and limestones. Granite rocks were supplied from Canada, it is true; but in their long journey these were generally ground to clay, though here and there "hard heads," which have escaped comminution, may still be seen on the surface. In the neighborhood of the Adirondacks, and other sections where the rocks are hard, the glacial soil closely resembles that of New England.

This soil of glacial origin varies greatly from place to place, so that innumerable minor influences of physiography upon occupations are found. There are glacial plains of compact clay soil that produce crops of apples and pears; there are very extensive beaches of gravel,—the seats of vineyards; there are thin soils, suitable only for pasturage; and there are sandy stretches of little value to the agriculturist. Some sections are smooth and regular; others are so hummocky that farming must almost be done by hand; and some portions of a farm are level, others irregular, some with good soil, others poor. It is along the terminal moraine that the most marked irregularities are found.

The rounded preglacial topography was rendered even less irregular by the ice visit. Hills were lowered by ice-scouring and valleys partly filled with the debris. Therefore, since it left a good soil, the glacier, by smoothing the surface somewhat, made the greater part of the State better adapted to the great agricultural interests which have since developed than it was before the glacial period.

Under conditions of variable soil and irregularity of topography an exceedingly varied agricultural interest has arisen in the State. It has not depended entirely upon the soil, but in part upon the climate and in part upon the needs of the people, developed through the creation of industries of other kinds than agriculture. The influence of climate, for instance, is well illustrated by the important fruit-belts along the shores of lakes Erie, Ontario, Keuka, Seneca and Cayuga, and also along the broad estuary of the Hudson river. The influence arising from the demands of people who are engaged in other industries is illustrated in the neighborhood of each of the cities of the State, where many men are engaged in raising crops almost exclusively for consumption in the cities.

But while these other influences must be considered, the most directly important controlling force in the agricultural development of the State is undoubtedly the soil itself. The glacial soil is strong, and will stand a great deal of unwise culture, although in time even the best becomes exhausted if too heavy a drain is made upon it. Soils of residual origin have been caused by the decay of rocks, during which most of the soluble material has been leached out, although enough is still stored up there to supply plants with the necessary food, and do it so readily that at first wonderfully rich crops are produced; but ere long this abundance of plant food is exhausted and the soil is run down, and has its fertility restored only with great difficulty. This is very clearly illustrated in the overworked and abandoned plantations of the South.

A glacial soil, on the other hand, being composed of rock fragments scoured from the ledges and by the grinding of boulders together, consists of many undecayed, or only partially decayed, rock fragments. These, under the action of frost, or the effect of roots of plants and other agents of rock decay, are slowly furnishing to the glacial soils the very plant food that the vegetation needs. There is, therefore, a steady supply of the elements of fertility, although not quite rapid enough to counteract the heavy drain made by over-tillage. The glacial soil is not a mere storehouse of plant food but a manufactory of it as well; and glacial soils are therefore strong and last for a long time.

THE BEGINNINGS OF MANUFACTURING.—A great agricultural industry, particularly one so varied and specialized as that of New York State, could not have developed unless a market were found for its products. The farmer may supply himself and family with food, and in a crude way may live and have the necessities of life even when entirely isolated; but he cannot go farther than this unless he is able to find some one who needs a part of his products and is willing to exchange for them something which the farmer himself needs. The pioneer settlers, of course, did not have this co-operation; but, just as now there are farmers living in portions of the Far West in practical independence of other people, so then the pioneers were dependent entirely upon their own energies and ingenuity to supply their pressing needs.

There are two natural means by which the products of the soil may be made of value in exchange, and fortunately New York possesses both of these, and the pioneers early developed them. If the natural facilities favor the development of other industries than agriculture, those engaged in these industries will need to be fed by the farmers. Or if people in more distant sections may be easily reached, the crops from the farms may be shipped away in exchange for other products.

From the very earliest settlement of the State other industries than farming have been in existence. At first there was trapping and hunting—a form of industry which supports but a limited population, and that of an unsettled kind, roaming about from place to place. The hunter and trapper is practically as independent of all other people as is the farmer in remote regions; but he, nevertheless, is able and willing to exchange products of the chase for the materials raised on the farm. While the trapper comes first in the settlement of the forested region, the wood-chopper usually succeeds him, sometimes destroying the timber for the purpose of clearing a patch of land for his crops, but often engaging in the business in an extensive way, clearing off the trees and removing the logs (Fig. 2). The lumberman, in a region of good soil, is naturally quickly succeeded by the farmer; so in the early days of the development of the State, after the trapper came the lumberman, and his occupation, not being a food-supplying one, demanded that he should be supplied with what he needed for food and clothing. As now, among the woods of Maine, little patches of meadow land, far away from the

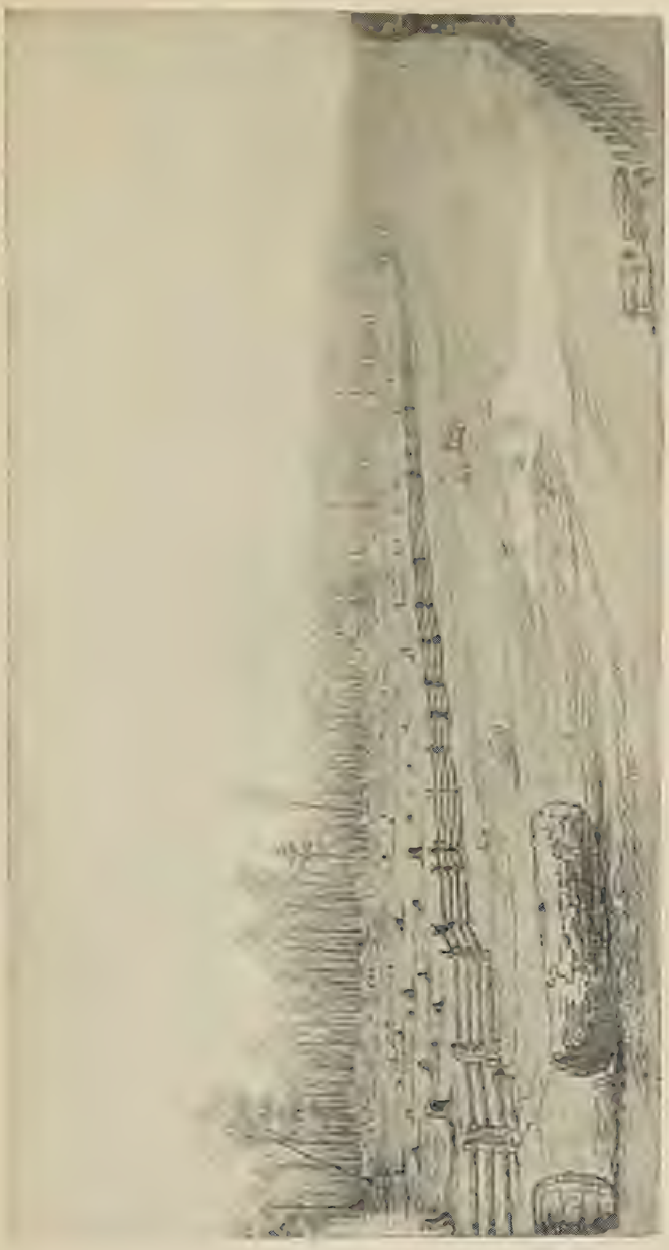

FIG. 2.—FIELD OF TREE STUMPS.

railways, supply their owners with an excellent living because of the crops of hay, potatoes, etc., which they produce for the lumbermen, so in the early days of New York history, one of the sources of profit to the pioneer farmer came from the demands that were made upon him by the lumbermen.

Timber-cutting means not merely the work of cutting the trees and floating the logs away, which would supply employment to but a limited number; it demands that there shall also be much work in preparing the lumber for market. As in the Adirondacks to-day, the lumber where it stands, or in that immediate neighborhood, is of very little value because of the absence of market, so while the forests in the agricultural part of the State were being stripped off, it was necessary not merely to cut the trees but to remove the lumber. As now in the Adirondacks, so then in the remainder of the State the removal of the forests was greatly facilitated by the waterways. Lumber could be floated down the streams and was removed in that way, and this fact has had a great influence upon the State, being of importance not merely because it served as a means for the removal of the forests, but also because it furnished one of the first great proofs of the importance of these waterways.

Therefore, early lumbering was an industry serving not only to employ the men immediately engaged in it—in cutting the trees, floating the logs and sawing them up—but also aiding agriculture partly by clearing off the forests which encumbered the land, and partly by furnishing some support to the growing industry of agriculture through demand for the farm products. It furthermore aided in the industrial development of the State by pointing out the usefulness of the waterways, whose later development has had such notable influence upon the prosperity of the entire State.

The necessity of making the rough logs into lumber and wooden articles, as barrels, laths, shingles, etc., caused the location of sawmills in various parts of the State. This work of transforming the rough lumber to various wooden articles was greatly facilitated by the numerous rapids and waterfalls scattered over the State as a result of the glacial accident which has turned so many streams from their courses and forced them, in choosing new courses, to tumble noisily along over the irregular rock layers. Most of these sawmills have now disappeared, and their water power has come to be utilized for other purposes, so that one travelling over the State at the present time would scarcely realize what an important step in the industrial development of the State this removal and manufacturing of lumber has been. It was the basis for the wealth of many of the families of New York State. Turning their attention to the removal of the forests from the land, they developed a capacity for this form of business which, when the opportunity disappeared through the removal of the forests, was transferred to other regions, even though the man himself remained living where he first began his lumbering operations. Some of the lumbermen worked toward the Adirondacks, other saw still greater opportunities in the West, and much of the development of lumbering in the Michigan and Wisconsin region has depended upon the skill previously acquired in New York State. Now that these western forests are disappearing, one finds the Wisconsin lumbermen transferring their business interests to other fields, as, for instance, the South. One of the unique and important results of this ancient lumber industry is found in the location and development of Cornell University, which owes much of its financial endowment to the lumberman's skill.

Closely succeeding, and in many cases even accompanying the manufacturing which was associated with the removal of the forests, came the development of manufacturing associated with agriculture. And since agriculture has permanently succeeded lumbering, the grist-mills, which were the first of the manufacturing plants related to the agricultural industry, have maintained their hold and are still in operation along the hundreds of creeks which flow with torrential course down their post glacial valleys.

THE LATER DEVELOPMENT OF MANUFACTURING.—Many other forms of manufacturing have developed as the State has become more settled. The grist-mills near the waterfalls of the Genesee at Rochester have developed greatly in importance, and the water-power is utilized for many other forms of manufacturing. The demand of the agriculturist for implements has led to the development of the immense Osborne plant at Auburn. Cheese factories and creameries have developed all over the State, and along the various water routes manufacturing towns engaged in many forms of industry have been established.

The debt that the manufacturing interests of New York State owe to the glacial accident can never be fully stated. The glacier left the country dotted with lakes; and it left many of the streams turned from their courses down slopes over which they flowed rapidly. For this reason, as in the case of New England, most parts of New York came into the possession of almost unlimited water-power. By itself, this might not have been developed as it has been; but aided by the facilities for transportation, and by the increasing density of the agricultural population, the region has, as the result of natural causes, become not only a great agricultural district, but also one of the most important manufacturing regions in the country, with large towns and cities and their consequent multitudes of workers demanding products which the soil is easily made to furnish. With this development of the home market there came also a differentiation in agriculture, until, in addition to grain raising, there have developed the industries of fruit raising, dairying, sheep raising, truck farming and the other great agricultural interests for which the State is noted.

The State has not begun to realize all of its natural resources of water-power, the most impressive example of unused facilities being Niagara Falls, also a product of the glacial accident. This immense cataract, for a long time merely a great fall, to see which people journeyed from all countries, is now, like its less notable neighbors, which exist by thousands in the State, being made to take a share in the industrial progress of New York. This almost inexhaustible water-power is being put to use, though it seems almost desecration to fill the beautiful gorge, and line its banks, with great tubes and unsightly power-houses, and to transform the border of the cataract into a busy city with its throng of unsympathetic workers. This is, however, an age of progress in which the needs of mankind take precedence over sentiment; and Niagara is destined not merely to light and furnish the electric power for Buffalo, but also to run countless manufactories in its neighborhood. It promises to become the greatest source of power in the whole world, and to furnish industrially a marvellous illustration of the grandeur of nature's forces, as it has in the past filled the traveller with awe.

Mineral Resources.—The mineral resources of the State have not done much, as compared with many other States, to aid in the industrial development of the region. Aside from iron mined in a few places, certain building-stones found here and there, and a relatively small amount of petroleum,—the northern continuation of the Pennsylvania field,—the State has supplied little else of mineral origin excepting salt. This latter product, however, has been of marked importance. While at present it is producing so great an output that it employs many thousands of workers, and determines the position of a number of towns and villages, in the past it was even more important, although its output was vastly less extensive. The salt springs at Syracuse, resorted to by the Indians, and used by them, became a centre of importance in the early days of pioneer travel; and later, when the settlers of the neighborhood needed salt, these springs led to the development of the industry which located one of the large cities of the State. Syracuse has passed the day when it was a great salt-producing city; but the seat of this early industry attained sufficient size to warrant its future development as a result of other industries.

The lack of coal would have been a much greater drawback to New York State had it not been for the presence of extensive deposits of this mineral not far away in the neighboring State. Very early this was transported into New York for manufacturing purposes, and across the State for use in more remote regions; and the coal-carrying trade of the early days was one of the important aids to the development of the great water routes of New York, and helped to determine some of the cities, as, for instance, Ithaca.

THE WATERWAYS.—A home and foreign market of the present size could not have been created in New York State had there been no natural facilities for the transportation of the products of manufacture. But with facilities for transportation, the agricultural industry of New York has far exceeded the demands of the immediate home market, and the products of the farm, as well as those of the factories, are sent far and wide. While at present man has in some respects risen considerably above the influence of his immediate environment, in the early days of the development of New York State the surroundings had an immense influence upon the conditions of life. In those days the time had not yet come when railways could penetrate into the remote, seemingly almost inaccessible, regions; natural pathways were followed, and among these the most potent have been the water routes.

The State is traversed by such a series of natural water highways that it has always been possible to travel by water over a large part of its area. Besides the two great lakes, Ontario and Erie—separated, to be sure, by the impassable Niagara Falls—there are Lake Chautauqua, the several Finger Lakes, Oneida Lake, Lake George, Lake Champlain, the St. Lawrence River, the Hudson, the Mohawk, the Susquehanna and the Allegheny, besides innumerable small lakes and rivers. Upon these the Indians travelled by canoe; and the early white pioneers followed the same means of entrance. Numerous falls and rapids required "carrys," and "carrys" were often necessary across divides; but, nevertheless, it was possible to penetrate deeply into the New York wilderness. The importance of this ready access is illustrated with great clearness in the early history of the State; the Dutch settlements along the Hudson, and the pushing of the frontier line up the Mohawk, and out over the plains of north-central New York, and along the lake shores, tell of the influence of the waterways.

Since railways were not then thought of, as the development of the State continued beyond the primitive stage when canoeing sufficed, the demand for better means of entrance and exit from New York naturally led to the construction of canals. Owing to the large river valleys, and to the numerous lakes, a few canals opened up to larger boats a great expanse of country. Each of these has had an important influence upon the development of the State; but the great scheme for the improvement of the waterways of New York was the building of the long Erie canal. Nature invited this, and the wisdom of some of the early statesmen of New York led to the acceptance of the invitation.

The sinking of the land, or its "drowning," had admitted the ocean tide up the Hudson River beyond Albany. The glacial accident had transformed two streams, one flowing westward, one flowing eastward, into the east-flowing Mohawk, with a gentle slope from the divide near Rome, with one or two exceptions, all the way down to the Hudson. From Rome westward there stretched a plain greatly levelled by glacial erosion and deposit, and covered so deeply with drift that for a large part of the distance from the Hudson to Lockport, the digging of the canal required merely earth excavation and little rock work. The one great obstacle to the construction of the canal was the escarpment at Lockport, to surmount which considerable ingenuity was required; but, after reaching the crest of the upper plain, the remainder of the route to Buffalo was simple. This opened up communication not only across the entire State, but to the then unsettled and unknown West. Short side canals connected the Erie canal with Lake Erie and the Finger Lakes, and these in turn were but a short distance from the Susquehanna.

No one can ever estimate the importance of this canal system in the development of the City of New York and the State as a whole. The direct benefits, when it was the only means of transportation of materials, are well understood. The indirect influence, in leading to the construction of railways, is, perhaps, not so widely appreciated. There are many who believe that the usefulness of this canal system is of the past; that the present day has outgrown the conditions of canal boating. Doubtless they are correct in so far as canals of the small Erie type are concerned; but no one who has thoughtfully considered the influence of the Erie canal on the past can have any question as to the future value of an enlarged Erie canal, which shall admit the ships of the lakes and furnish a free passageway across the State. There are always those who question the value of large expenditures; there were such objectors at the time of the proposition of the Erie canal itself; and there are even now those who question the wisdom of spending large sums in further improvements; but fortunately it is a characteristic of our race that objectors of this kind are always in the minority.

A combination of physiographic causes has conspired to make New York City a great commercial centre. The aid of man in the construction of canals, and later of railways, has determined that it shall be the greatest commercial centre of the nation, and doubtless, in the not very distant future, of the entire world. It stands at one of the gateways into the interior of the continent, the other two being the St. Lawrence and the Mississippi. The mouth of the latter is too far south, and the most productive part of the country is too distant and too difficult to reach. The St. Lawrence, with its great city of Montreal, furnishes another natural gateway into the continent; but it is frozen for months, and, owing to the fact that the international boundary practically prohibits its use as an exit for the products of the northern United States, it leads into a much less productive section than the Hudson gate. The latter reaches back into the most productive portion of the American continent. Railways now centre toward the splendid harbor at the end of the Hudson estuary, and ships that pass down the Hudson, and the canal boats that travel from the West, are headed toward this great shipping point. It is needed now to make water connection more easily possible.

This is but a general statement of some of the more salient features upon which the development of the State as a whole has depended, a mere hint as to the direction in which it would be easily possible to extend the discussion if we were to commence upon further detail.

It might readily be shown why some parts have become the seats of the dairy industry; others of grain production; others still of vineyards, orchards, etc., either because of features of climate or soil or physiography; and it might also be shown that some portions have remained nearly unsettled, and are destined to remain so in the future because of distinctly unfavorable conditions. Moreover, there is scarcely a town whose origin and development have not been profoundly influenced by the surroundings. In some it is water-power and manufacturing; in others, agriculture, or the outlet of a canal, or the discovery of iron, salt, oil, or other mineral products, etc. We could also dwell upon the influence of physiography upon those great aids to commercial development, the railways, and study in detail how closely they have been obliged to follow natural routes. One gains an impressive lesson in this connection when he attempts to travel by rail from central New York to western Pennsylvania.

FIG. 3.—EARLY BUFFALO.

How Buffalo has grown as New York City has developed, because goods bound to or from New York City have needed to have their mode of transport changed from rail or canal boat to lake boat, or *vice versa!* What a chain of important cities there is along the natural water route and its improved extension, the Erie Canal! This is no mere matter of chance; nature provided for it and man merely accepted the conditions, adapted himself to them, and improved upon them where slight improvement promised great reward.

This point of the dependence of industrial development upon the natural conditions is one to which especial attention needs to be called in these days when man so easily overcomes obstacles, causing railways to ascend to the mountain passes or to plunge directly through the mountain. Now, man is in part the master of his surroundings; but even at present he is not fully free from their influence, and the time was when the environment, more than any other single cause, directed his movements and guided his progress. We ought not to be allowed to forget this.

THE FIVE CIVILIZED TRIBES: INDIAN TERRITORY.

BY

C. H. FITCH.

With the exception of a small area in the northeastern corner, belonging to several small tribes of Indians, Indian Territory comprises the lands of the Cherokees, Creeks, Seminoles, Choctaws and Chickasaws, five tribes, known as the Five Civilized Tribes, and to these tribes, just on the eve of important changes in their tribal governments, consideration is here given. Their lands were deeded to them upwards of seventy years ago, when the need of more room for the settlers in the South made their removal from the Southern States desirable. Then the country adjoining Arkansas on the west seemed a good place to send them, and at that time it was considered so remote from white settlements that, in all probability, no thought was given to the possibility of disturbing them again. It was intended to settle them there for all time, where they could live to themselves, according to their own pleasure, with self-government, under the protection of the general Government. They were thought to be sufficiently advanced in civilization to be able to continue the improvement already begun, but the results show that this belief was unfounded, as far as the full-blooded Indian is concerned, since he is to-day no further advanced in civilization than before.

Indian Territory is a beautiful country, particularly during the spring of the year, when the warm sun and frequent showers have produced a most luxuriant covering of grass over all the hills and valleys. The great profusion and variety of wild flowers and the fresh green of the oak forests, just putting out their leaves, adds to the beauty and richness of coloring; and the homeseeker, in passing, is tempted to leave his train to investigate the possibility of securing a farm there, even if he is obliged to rent it instead of buying the land. Later in the season, when all is dry, and the weather warm, the country presents a different appearance, not so attractive, but with occasional showers at longer intervals the crops of cotton and grain mature without great effort. In fact, it seems to be an easy matter to gain a livelihood in Indian Territory; indeed, it is easier to raise cotton than to pick it, for it often remains in the field unpicked when the time for planting comes again.

The Spanish explorer, Coronado, saw this country over three hundred years ago, and the secretary of his expedition describes it as more beautiful than any country that he had ever visited, either in America or Europe, and it must have appeared to the Spaniards a remarkable contrast to the dry and arid regions lying to the west, through which they came on their journey from Mexico.

The spurs of the Ozark Mountains, extending into the Territory, are quite high and rugged, and form deep gorges or cañons, through which mountain streams of good water flow all the year. The larger streams of this character are the Grand, Illinois, and Kiamichi Rivers. They are picturesque and wild in their surroundings, and the heavy forest growth of pine, cedar and oak affords most excellent shelter for the wild animals, which are so abundant as to make this one of the best game regions in the country.

Quail are numerous everywhere, and on the open ground prairie chickens are still found. The water-ways in the fall and winter furnish the sportsmen an opportunity of shooting many varieties of ducks, and all the year are full of fish. But in the mountains and woods wild turkeys, squirrels, deer, bear and cougars are to be found in great numbers, although no effort has been made to preserve the game, and the neighboring States supply hunters in hordes in the winter months.

The Arkansas, Canadian and Red rivers, and most of the other streams not in the hill country of the Indian Territory, are the characteristic rivers of the semi-arid west, broad and shallow and often dry, flowing through wide valleys, subject to sudden overflow in rainy seasons and doing much damage to farms and improvements. When the waters recede, the river may be found in a new channel, as, for instance, when the Canadian River flooded the country in 1898, and washed away long sections of the track of the Missouri, Kansas and Texas Railroad, a new channel was formed over two miles from the old one, where the iron bridge still remained, but without a river beneath it. To avoid the expense of a new bridge, which might again be deserted by the river in another year, the company succeeded in obtaining permission, by Act of Congress, to turn the river back by a canal to the old river bed.

The Indians knew something of the country that was to be their new home, for their young men had gone out to it in previous years on hunting expeditions and found it teeming with buffalo, deer, turkey and other game. There was plenty of timber for fuel and to build their log cabins, and an abundance of grass for their horses and acorns to fatten their hogs. Much of the land was rich and cultivable, but they had no desire to till the soil for anything more than a little corn for food, but not to sell. There was some dissatisfaction at first about leaving their old homes, but about 1835 nearly all had reached their new possessions and soon were quite contented. The lands were deeded by the United States to the several tribes or Nations, not in severalty, however, but to each Nation its own parcel. The United States having conveyed the title in the lands to the Indians, they were secure, as they thought, forever. Indian lands usually are reservations set apart for the use of Indians during the pleasure of Congress, but in this instance the lands were deeded to them, and the Government of the United States agreed to protect them and keep out all intruders.

The present possessions of the five tribes contain an area of about 30,000 square miles and are a part of their original holdings, they having sold off from time to time large bodies of land now included in Oklahoma Territory. Large sums of money have been paid and divided among them, and in some instances a part or all of the purchase money has been held for them in the Treasury of the United States and the interest paid annually. They have ample school funds and have built large and substantial buildings for seminaries and boarding schools. They have also their public buildings, erected out of money thus paid to them. Various missions also provide educational facilities for Indians, but there are no schools for white children. The full-blood Indians have from the first sought the seclusion afforded them in the mountainous and timbered regions of the east half of the Territory and they have never mingled with the whites or in any way advanced their condition by education and civilization.

There are no "blanket" Indians in Indian Territory; all, even the full-bloods living in the most remote sections, dress in civilized fashion. Their native fondness for bright colors is shown principally by the women in their brilliant-hued calico dresses, neck handkerchiefs and shawls. They are fond of games, principally Indian ball, and cling to many of their original customs. Their game of ball is interesting and exciting, being somewhat similar to football, and quite as rough and dangerous. The ball is very small, not as large as a tennis ball, but it is not handled with the hands or kicked with the feet. Instead each player is provided with two sticks of hickory, with small cup-shaped ends, whereby the player deftly picks up the ball from the ground and runs with it, or endeavors to throw it to the goal. When the game is indulged in by opposing teams of different counties or Nations the greatest interest is shown and large crowds congregate to witness it.

Those of the Indian citizens who have a mingling of white blood, and the white men who by marriage have the rights of Indians, have enjoyed to the fullest extent the advantages given them to hold and occupy lands for farms, and immense pastures have been fenced for their cattle, the grazing of which is a large and prosperous business in the Territory.

Early on their arrival in the Territory the several Nations proceeded to organize and form their governments, each tribe or Nation being entirely independent of the others. They elected officials, executive, legislative and judicial, and proceeded to enact laws and enforce them. Under their system the lands were free to all Indian citizens for as many acres as they wished and for as long as they cared to possess them. They took with them negro slaves and held them as such until after the Civil War, and for this reason it was natural that the Indians should have sympathized with the slave-holding States when the war came, and that they should have furnished men for the Confederacy. After the war the Indians were forced to recognize the right of each slave to forty acres of land whenever in the future the lands should be divided. The popular belief prevailing at that time among the negroes of the South, that they were each to be given forty acres and a mule, came from this provision of land for the Indian Territory slaves. The Indians were not disposed to do much cultivating of the soil, preferring to eke out an existence by hunting and fishing, only raising small quantities of food. Later white men, seeing the advantages of soil and climate, obtained a foothold through leases from individual Indians, and by paying tribute secured permits from the Indian Governments. The Indians have claimed that the United States failed to fulfil its promise to keep out intruders—and certain it is that they have not been kept out; but it is contended that the Indians invited them there for the purpose of increasing their revenues. Under this system the country soon contained more whites, or non-citizens, than Indian citizens. In speaking of the Indians, all so-called citizens are included, many of them having merely a trace of Indian blood. Farms were cultivated, pasture lands fenced and coal mines developed. Still, it might be called an undeveloped country. Those engaged in these pursuits had no real title to lands, and their improvements, as a rule, were such as would naturally be made by temporary occupants, although there are substantial and costly buildings in some of the towns.

The country has been sometimes terrorized by desperadoes and train robbers, but, as a rule, these rough characters came from the neighboring States and Territories, and generally the country is peaceful and not nearly as bad as painted. Every "gang," like the Daltons, was sooner or later run to earth and captured or killed, and in such a short time that of late years there has not been much encouragement to engage in the "road agent" business.

Under the necessity for railroad communication between Texas and the North, the first railroad was started across Indian Territory south from the Kansas line about the year 1875. A charter was granted across the Territory by Congress to the first railroad which should enter it from the north. The railroad company which expected to avail itself of the charter was somewhat slow in starting to build, and another road, which afterwards became the Missouri, Kansas and Texas Railway, saw the opportunity and seized it, building night and day on the prairie, laying tracks without preliminary grading until after they had crossed the line and earned the right to continue through. Now there are several lines across from north to south and from east to west. The advent of the railroads caused the development of the coal mines and numerous towns to spring up along their lines. The mines are operated under leases and pay royalty to individual claimants and to the Indian Governments. Traders and tradesmen, farmers, mechanics and professional men pay for their permits, and thus the Indian Governments are enabled to pay their expenses. The Indians were quite satisfied with the conditions, they having the best of it, and all the right on their side. The intruders, or non-citizens, were not satisfied, however; they wanted more rights and privileges. They wanted schools for their children, town organizations, police and fire protection, improvements of roads and streets, and other things that go with progress and development in a new country. The Indians contended that they had no right to be there and that if they remained they should accept the conditions as they found them. In this age, however, it is impossible to keep the average American out of any place where, in his estimation, he can by energy and pluck add to his capital in developing the resources of a country. The situation was somewhat analogous to that in South Africa to-day. There were at least five "intruders" for every Indian citizen. It was almost an impossibility to put them out; they were there, and to stay, and they wanted a better chance to live and enjoy the country, and a government with white representation. That a change must come was apparent to the most enlightened of the Indians. In each Nation there are two political parties—one representing the full blood element, bitterly opposed to any change, and the other the progressive element, recognizing that the prevailing conditions could not last much longer and that a change was inevitable. There has been and there still is strong feeling on both sides. In each party there are men of force, ability and intelligence, but of late years the latter party seems to be gaining in strength.

A number of years ago a commission was appointed, under authority of Congress, commonly referred to as the Dawes Commission, to treat with these five tribes, and endeavor, if possible, to arrive at some solution of the problem which would be acceptable to the Indians and to Congress. At first the Commission met with a very cold reception, the Indians refusing to hear of any proposition involving any sort of a change in their tribal relations, but gradually, after years of patient waiting, they have finally listened, and, in some instances, have concluded agreements satisfactory alike to the Government and a majority of the Indians. The Act of Congress, known as the Curtis bill, which became a law during the last session of Congress, provides for allotment of the lands in severalty and for the survey and disposal of town sites, adjustment of leases of mineral lands, and also abrogates the tribal courts. Within the next few years an entire change of affairs in the Territory will take place, the Indians will take their lands in severalty and dispose of the town sites, so that the towns and their organizations will be largely owned and controlled by white men now classed as intruders. By some system, probably by leases, all of the cultivable land will gradually become improved and settled upon. Good farms now exist, generally under the lease system heretofore mentioned or held by individual Indian citizens of white blood. Many holdings will be reduced in size, but the aggregate number of acres cultivated will be increased many times, and the Territory will soon take its place as a productive agricultural country, sending to market vegetables, fruit, grain and cotton; also wool, mutton and beef from the pasture lands; an increased output of coal will find ready sale near at hand, the asphalt lands of the Chickasaw Nation will be developed, and, in all probability, petroleum and natural gas will be discovered to add to the riches of this already rich country. Pine lumber, pencil cedar, walnut logs and oak ties will become more abundant as articles of commerce. The lands have been surveyed into townships and sections, which is the first step in making the allotment; but it will take several years to segregate the town sites, adjust the leases of mineral land, and appraise the balance, and to make an equal division among the representatives of the several tribes. To satisfy all and to make a fair apportionment of the land, which ranges from the rich, alluvial soil along the rivers to the almost valueless, stony, barren hillsides, will be a difficult task, but the sooner it is accomplished the better for all concerned. Until the division of the lands is an accomplished fact progress in the development of the country will be much retarded. The impending change is realized, and it causes an uncertainty and unsettled condition that must continue until a new order of things assumes some definite shape. We cannot blame the Indians for their desire to cling to the old order of affairs; taking their point of view it is hard to give up control of a country that has so long been theirs. They realize that they will be outnumbered and soon lost sight of in the government of the Territory, and that where they have been of the greatest importance they will have no voice in the management of a new organization. There is no help for it, however, and no advantage will be gained by longer striving to put off what appears to them an evil hour. It is inevitable and must be apparent to all of them by this time, although it has come upon them in a gradual way. It is to be hoped that the full-blooded Indian will be benefited by the change, and that by the necessary mingling with the whites his education and condition will be improved. He should be given his land to hold and not be permitted to sell, at least for a long term of years, so that in time he may be able to know and understand the value of his home. The white, or nearly white, citizens will be able to take care of themselves in any environment, and are quite as capable of so doing as any class of people they may be brought in contact with. But the real Indians will need all the protection that can be given them, for they are totally unable to take care of their own interests. They are located in the woods and sterile lands in out-of-the-way places, and, in all probability, will prefer to keep to themselves as much as possible; but if they could be induced to come out of their seclusion and take fertile lands, they might, in time, with encouragement, become good citizens and as good farmers as their neighbors. After all they are the ones needing the most sympathy, and as there are but few of them, it would seem possible to aid and protect them in the final distribution of the lands and moneys and by the enactment of laws, looking to a proper and careful administration of their affairs. They should be treated as minor heirs in the division of a great estate, and allowed every consideration favoring their immaturity, but impelling and encouraging their development.

PALESTINE AS ILLUSTRATING GEOLOGICAL AND GEOGRAPHICAL CONTROLS.*

BY

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THE SCENERY.—We have seen that most of the historic hills of Palestine bear to the plateaux the same relation as that of the finished cameo to the flat surface of a still uncut plate of onyx, agate or shell. They have been etched out by rivers, by the erosive power of rain, and by the freighting of waste down the wadies to lower ground. Thus, the tourist on Tabor, Little Hermon, Ebal, Gerizim or Gilead will not only look down into the Ghôr; he has also unimpeded views toward every other point of the compass, across valleys of erosion which encircle the hills. Mt. Ebal, where the six tribes of Israel pronounced the curse on disobedience, is sundered from Gerizim, on which the other six tribes chanted a blessing on obedience, by just such a wady, narrow and deep, across which the voice of a single person carries well. Others of the hills are, in a sense, very comparable to the buttes that stand up on our western plains, and bear witness to well-advanced destruction of the surrounding parts of the plateau.

It remains for us to note the conditions which have produced the scenic details of the plateaux. Great Lebanon and Hermon may be taken as types. From the foot to the summit of each of these nine thousand-foot "mountains" is as great a climb as that from the plains to the top of most of the peaks in the North American Cordilleras. Expecting much of scenic beauty from massifs of so great altitudes, the average tourist is disappointed in these two; yet this very disappointment is of value if it be accompanied by the conviction that the American Rocky Mountains or Swiss Alps on the one hand, and the Syrian uplands on the other, furnish two entirely different kinds of landscape. It is not the general difference of vegetation, the contrast of the bare Palestinian scarps and the wooded slopes of the Rockies; for he would find on the treeless spurs of the Caucasus even more grandeur and wild confusion than in many justly famous American mountains. In the Lebanons there is less of grace and serrate irregularity than in the Rockies or in the Alps; more of massiveness, simplicity and strength. The contrast is striking; the cause definite, and not far to seek. Either in the Alps or in Lebanon the rocks are of differing hardness, and they will resist erosion in quite different proportion. Where, as in Lebanon, the strata, for the most part, lie nearly horizontal, the process of wear will produce horizontal lines on the edges of the beds, and vertical lines in the profiles of the retreating cliffs; but the folded, contorted and otherwise deformed strata of the Alps will so yield to the destructive activities of meteoric waters that the fretted edges of the layers will run in all directions in plan and stand at all angles, from vertical to horizontal. There results, in the one case, the scenery of a true plateau, albeit the "glory of Lebanon," in the other that of a typical vigorous *mountain;* the sculpture of a Colorado cañon is possible to the one, the fashioning of an Inn Valley to the other.

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* Continued from Vol. XXXI, page 458.

THE CLIMATE.—It would be quite out of place to describe here the ultimate causes of the Palestinian climate, even should they all be known. Some of the proximate causes may, however, be noted.

The complex phenomena which make up climate are conveniently grouped about the seasons; in Palestine these number but two, and throughout the Biblical writings only two are mentioned. There is no real spring and autumn in our western sense, for the warmth and dryness of summer has pretty definite limits in the coolness and wet of winter. They are the familiar "dry" and "wet" seasons of many a tropical and sub-tropical land. To this day the beginning of the rainy season occurs usually in late October, as the "early" or "former" rain, all-important to the husbandman as a condition of his ploughing and planting his crops in the ground baked during the hot months of summer. Following a period of drier weather, the heavy rains begin again and continue at intervals until March. Then comes the question whether the precipitation shall last into April, inasmuch as upon this "latter" rain depends the full rounding of the ear and final ripening of the barley, and later of the wheat, for the two chief harvests of Palestine. Full of meaning was this climatic feature of the land of promise: "I will give you the rain of your land in due season, the first rain and the latter rain, that thou mayest gather in thy corn and thy wine and thine oil."

On the other hand, so rare is rain in time of actual harvest that it was even made the basis of Elijah's miracle in calling upon the Lord, who sent a thunderstorm over the land at time of wheat-harvest.

This trenchant distinction between the seasons as regards precipitation, is, in a large way, not difficult to explain, though too little is known of the meteorology of Palestine to permit of our going into details. In brief, rainfall is a function of wind-direction and of the thermal conditions of the land-surface.

The common winds of summer are those from the north and northwest, which cool the land and go far to account for the salubrity of the country. Like them, the usual afternoon sea-breeze is a "drying" wind, since all these winds are warming up as they pass over the limestone hills and are ready to absorb still more moisture instead of giving it out by condensation. Likewise in summer, for many days at a time, it may be, the wind blows from the east or the southeast, representing the Scriptural "east" wind, the influence of which is typified in its blasting the seven lean ears of Pharaoh's dream. The south wind, "which bringeth heat," is also of the nature of a true sirocco, a hot wind from the desert, laden with desert dust and incapable of furnishing moisture to the plateaux of Palestine.

In their physiological effects the east and southeast winds quite change character as the winter comes on; they become stimulating and bracing. They behave, however, like the cutting and disagreeable north wind in preserving a dry condition. It is the westerly, chiefly the northwest and west, winds that give out the rains of winter. Relatively moist from their long journey over the Mediterranean, they precipitate their load on coming in contact with the cooled surfaces of the coastal plain and plateau, which radiate rapidly the heat derived from a winter sun. Although the average annual rainfall of the plateau is only half that of Boston, Massachusetts, yet this amount of precipitation represents most of that which is afforded by the moisture-bearing wind. By the time it has passed the edge of the escarpment overlooking the Ghôr it is already greatly dried; the sponge has been squeezed. Moreover, this same wind, on descending into the graben, is compressed, thereby warmed and hence endowed with the capacity for more water-vapor. For these reasons, the Ghôr must be content with a rainfall that keeps it, for the most part, in the condition of a typical desert, of a climatic belt remarkably distinct from that of the western plateau. As we might expect, the average annual temperature is much higher (6° C.) than at Jerusalem, and the scanty flora and fauna of the graben about the Dead Sea are tropical, being allied to those of Egypt and of Hindostan. Impoverished as it is, the westerly wind is yet able to supply the eastern plateau with a certain amount of rainfall, though far less than the more favored slope of the Mediterranean side. The climate of the two plateaux is otherwise somewhat similar, and the orchards and farms of Philistia and of Judæa correspond to the grainfields of Moab.

In these general relationships exists the well-established parallel between the climates of Palestine and of California. For the climatologist, the Coast Range is equivalent to the Judæan Plateau, the Great Valley to the Ghôr, and the Sierra Nevada to the range of Moab. The two countries lie in the horse-latitudes; each has a single cloud-breeding reservoir on the west. The summation of so many similar conditions gives in each land two seasons, an "early" and a "latter" rain, a perennial afternoon sea-breeze, a tendency to the development of "northers," a marked salubrity of climate on the western uplands, a less fertile eastern upland and an intermediate desert lowland.

PHYSIOGRAPHIC CONTROLS.—It has been shown that the topography of Palestine may be explained by reference to a series of geological changes, and that its climate likewise depends, in large part, on the topography and geology. Finally, it may be noted that climate and topography have governed the habitability of Palestine, the industries of its varied inhabitants, and their history—military, political and ethnographic. A convenient phrase has been invented to express the sum of natural conditions which determine in any region the activities of man in the region. These conditions are called "physiographic controls." But little has been done toward developing the doctrine in its detailed application; yet it is to be accounted one of the chief aims of geography, for, not until it be so developed is a thoroughly scientific, political and commercial geography possible. The following paragraphs are intended rather to illustrate the principle of controls than to sketch all the phases of the subject.

The rocks of Palestine, practically without exception, belong to varieties which are competent to furnish good soils, provided there be sufficient rainfall; hence the four zones of rainfall are also well-marked zones of fertility. The richest of all, the Sharon-Philistia plain, corresponds to the coastal plain of alluvium; the next most fertile belt is the western plateau; the eastern plateau has a rather less-favored vegetation, that soon fades out in the vast desert of extra-Moabite territory in the east. As it is alluvial ground, we should expect the valley of the Jordan to produce heavier crops than the plateau; yet, for reasons already noted, it is a barren plain, except where springs supply water enough to show such capabilities as in the oasis of Jericho. The scantiness of population in the valley is at first sight inexplicable, for the most primitive sort of irrigation would afford abundant harvests. The fact is probably due to the unhealthy nature of the low ground; the few people who do live in the valley are described as feeble in comparison with the other inhabitants of Palestine. The uplands, on the other hand, are very salubrious; Jerusalem, twenty-six hundred feet above the sea, is fever-stricken for quite local causes.

Hand in hand with the food question, is the problem of water-supply. It is only within a few decades, and with the growth of the great cities in Europe and America, that to the people of the more fortunate Western lands, this question has become of real economic importance, *i. e.*, one of supply and demand, which results in actual payment for drinking-water. But in Palestine it was, and is an ever-present question, the occasion for tribal and family ventures, in which the stakes were human lives and the possession of the living waters. We have seen why this should be so: a scant rainfall and the disappearance into subterranean courses of a large proportion of the rain-water, falling on the permeable limestones, have worked together to make the springs and oases the coveted source of wealth for all generations. From Genesis to Revelation, the rejoicing in the beneficial showers and perennial brooks and "fountains" has characterized many of the finest and poetic passages of drama, chronicle or psalm. In rainless Egypt, and Sinai, the people of Israel cherished the promise of their leaders, "For the Lord thy God bringeth thee into a good land, a land of brooks of water, of fountains, and depths that spring out of the valleys and hills." As the light of hope breaks through the wild despair of Zechariah, to whom came the vision of a reconstructed kingdom, he exclaims not only that "at evening time there shall be light," but adds the triumphant note, "It shall be in that day, that living waters shall go out from Jerusalem."

The student of the Hebrew literature cannot be fully sympathetic with his subject unless he visualizes clearly the physical conditions of a perennial water-supply; neither will he appreciate the significance of the numerous references to wells, cisterns and reservoirs or "pools." For that time and country the digging of the wells of Beersheba by Abraham was like the founding of the great sea port and capital city by Peter the Great, or like the razing of the Bastille—an event of peculiar national importance. The Philistines saw the advantage of holding the larger wells during their military operations; at Bethlehem they caused even David himself to suffer from the thirst which he was too magnanimous to allay at the risk of the "three mighty men of valour." It will be remembered that, when Moses sent messengers to the king of Edom asking for permission to pass through his country, it was expressly stipulated that the people of Israel would not drink of the Edomite wells, so precious was the store of water!

Not only is rainfall a dominant condition of the varying fertility, salubrity and water-supply of Palestine; it explains in a general way the everyday callings of the present mixed population as it did the similar occupations of early Israel and of the Phœnicians. Sheep-raising has always been the staple industry of Trans-Jordan and of southern Judæa, and it plays a part in the life of the western plateau. It is almost a truism that the shepherd's life is a nomadic life, especially in a region of widely-separated oases and pasturages. For this reason, the patriarch in tents, with his family around him in tents, has persisted in this land from the dawn of history to the present day. Such a life is not a busy one, and the early employment of slaves made it still less absorbing for the stately heads of these migrant tribes. Thence came, as Renan points out, abundant leisure for introspective thought, for reflection on the problems of life. It can hardly be doubted that the many long centuries of nomadic existence had a capital influence in bringing to fruition the unique genius of the Hebrews for the development of moral and religious truth. Renan further shows that such a life forbade the maintenance of temples and of an elaborate worship of idols; that it was therefore easy for the monotheistic idea to take root; that both Judaism and Moslemism originated under these same conditions; and thence that the patriarchal idea may be regarded as "the corner-stone of religious history." *

The influences of the patriarchal life persisted long after the Israelites had entered the Promised Land. Then their history underwent a complete change, due once more to a physical necessity. Kept from the sea by the doughty Philistine, who, by his energy, resources and superior methods of fighting in the open country, kept at bay the restless Hebrew, the men of Israel never

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* Compare the views of Dr. G. A. Smith in his masterly treatise on "The Historical Geography of the Holy Land" (1894).

attained a maritime spirit. Neither did they use the easily-acquired mineral wealth of the Ghôr, since there was little demand for its peculiar products; nor did they mine the immense iron and coal beds of Lebanon. The relatively great fertility of the plateau entailed, however, the possibility of a more comfortable existence, that of the farmer, and his settled abode was taken, for protection, around the numerous towns, which controlled, in addition, the simple manufactures of the times.

Sedentary from this time forth, this people became more and more diversified into distinct tribes, which gained their individuality on account of the varied character of the plateaux. Separated by the deep wadies, by fault-scarp or desert-plain, the tribes gradually differentiated during the centuries, much as the canton-folks of Switzerland are now contrasted with one another. Dialects arose, which it is fair to suppose were non-existent at the time of colonization; jealousies appeared between the nomads and the men of agriculture; many times civil war broke out among the blood relations; and thus we find Jephthah, the Gadite of Mt. Gilead, putting to death Ephraimites from the other side of the graben when he found that they could not pronounce his famous sibilant, and thus revealed their "foreign" extraction.

The influence of the Ghôr in preventing the easy mixture of peoples which were originally of common ancestry, and in bringing about their differentiation, had already been felt in the history of Palestine, for just before the crossing of the Jordan by Israel, the Amorites of the western plateau, once of one blood with the Moabites, had so far forgotten the family tradition that they marched against Moab as against a stranger and conquered the land. On a far larger scale, this mighty barrier kept alive the age-long animosities of the Israelites towards the Moabites, Ammonites and Edomites of the eastern plateau, whose customs, religions and languages had greatly diverged from their own. It is fair to suppose that, had all this country been plain, no such striking differentiation could have taken place, nor an occasion for the refrain, "Edom shall be a possession; Seir also shall be a possession, which were his enemies."

The strategic importance of topography in the Palestinian wars would furnish the subject of a fascinating chapter in the history of that country. The success of foreign arms in the land is not to be attributed to any lack of valor among the Jews, nor to the absence of means for ready defence; it was rather due to the incoherence of the tribes, which, if they had been united under the control of a single centralized military rule, could very probably have repelled invasion simply by making use of the magnificent natural ramparts of the land. The brave Maccabeans and the energetic Josephus understood their opportunity when they respectively faced the disciplined armies of the Great Antiochus and the legions of Titus. The battles of the three passes and the tragedy of Masada are strong illustrations of the close dependence of national defence on topography. So Barak's army waited for the Syrians on the dome of Tabor, Josephus fortified it, and Napoleon's generals used it as a a point of vantage whence they drove the countless Bedouins of 1799 into the marshes of Kishon. To this day the numerous Druzes and Maronites of Lebanon, comparatively safe within their stronghold, have successfully preserved their individuality and religion in the face of Turkish aggression.

It has forcibly struck almost all modern writers on Palestine that its topographic relationships have governed the course of history in an important way quite different from that of influencing the development of the Jewish race, with its religion and its peculiar tribal attributes. A cosmopolitan interest attaches to its position as a long, narrow strip at the extreme end of the great water-way of the ancient civilised world, the Mediterranean, and between the two world-granaries of former days, the Tigris-Euphrates valley and the Nile valley. To the east are the deserts of Syria and Arabia—the most effective of barriers to the advance of armies bent on conquest. These must, then, in passing between Africa and Asia for land operations, use the natural pathway of a fruitful, water-bearing route that the coastal plain and western plateau of Palestine alone supply. Hence this little country has witnessed the march of Egyptian, Babylonian, Assyrian, Persian, Greek, Roman and Turkish troops, led forth to conquer the rich plains of Babylon, of Nineveh or of the Pharaohs, or to secure the only gate opening into the land-route to Persia and India on the one hand and Europe on the other. Alexander the Great opened the door and was successful in keeping it open until he had completed his scheme of world-dominion; Napoleon essayed to reach India by the plain of Esdraelon, Damascus and Persia, but was repulsed by Englishmen at Acre.

Partly because of the shifting of political centres of gravity, partly because of the discovery of other routes, partly because of the use of steamships and of the Suez Canal, Palestine has lost its once commanding position as a military gateway between east and west. The commerce of the Syrian ports has, for similar reasons, faded into insignificance. For many centuries they had interchanged the goods of the world, not because they possessed good harbors—they are, in fact, among the poorest on the Mediterranean—but because this strip of shore lay near the junction of three continents, the surplus products of which must needs pass that way. Yet, were the political and natural conditions of twenty centuries ago to return, commerce would once more thrive in Tyre and Sidon.

The chief object of the foregoing sketch shall have been met, if the reader recognizes that the geographical facts concerning Palestine form a single great system; that the relief, drainage, climate and resources of that land are all, directly or indirectly, the effects of the geological history, and together, the causal conditions of human life, industry and history within the borders of southern Syria; and that the old Eocene sea-bottom possessed potentialities which had, so to speak, as their logical consequences, the development of a Levant, the existence of a Jordan River, the rise of that marvellous Jewish race, the brilliance of a long-continued Phœnician civilization, the Crusading romance, a Napoleonic campaign and the massacres of the Christian Maronites of a later day. In particular, I would emphasize how excellently well Palestine illustrates the influence of barriers on animal and plant life and on the human inhabitants. Orographic barriers are represented in grabens, fault-blocks, fault-scarps and erosion-scarps; climatic barriers in the wide wastes of desert land in Syria, Arabia and Sinai. We have noted that it was impossible for men to occupy the separate basins, valleys and plateaux without becoming characterized by tribal peculiarities, and hence that a uniformity of population as among the Indians of the Mississippi Valley or of the plains of Paraguay, or among the governments of Great Russia, is here neither expected in theory nor discovered in fact.

The climate has conditioned the nomadic life, and with it the peculiar strength of family life and of the principle of obedience; and has undoubtedly had an important influence in moulding the moral and religious ideas of the Hebrew people. It is, of course, not intended to minimize the difficulty of allowing for the innate, and, as yet, unexplained springs of conduct which were the inheritance of the races of Palestine before they entered the country. Free volition and a particularly enterprising nature must have played a large part in the formation of Phœnician commerce, since the smooth-flowing outline of the Levantine coast-line is, in truth, more a discouragement than an incentive to navigation. Yet we have seen that, even in this case, there is some good physiographic explanation of the phenomenon.

Finally, a preliminary review of Palestinian physiography from this genetic point of view may be commended to the student of the Old and New Testaments; to narrative and literature it lends a vividness and a concreteness which cannot fail to stimulate both the memory and the appreciative faculty.

A DICTIONARY OF TOPOGRAPHIC FORMS.

BY

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The following list of definitions is intended to include all those terms employed popularly or technically in the United States to designate the component parts of the surface of the earth. So far as practicable, the endeavor has been to refrain from defining such words or using such definitions as refer merely to the origin of the various topographic forms. At the same time it has been found necessary in a few instances to define forms according to their variety of origin, as those resulting from volcanic or glacial action. In the case of names which are locally peculiar to a limited portion of the country, the effort has been to indicate the regions in which they were employed. The language whence derived is denoted by Sp. for Spanish, Fr. for French, etc.; the word "origin" following indicates that it has been generally adopted in American nomenclature.

The manner of spelling *canyon*, *amphitheater*, etc., herein adopted, accords with the usage of official government publications. The writer has not hesitated to extend or restrict the meaning of some words where the result is in accord with even only occasional usage, when by so doing he has added a distinctive meaning to them, and has thus aided ever so little in enriching topographic nomenclature.

ACCLIVITY: An ascending slope, as opposed to declivity.

ALKALI FLAT: A playa; the bed of a dried up saline lake, the soil of which is heavily impregnated with alkaline salts.

ALPINE: Pertaining to high, rugged mountains containing glaciers; resembling the Alps of Southern Europe.

AMPHITHEATER: A cove or angle of glacial origin near the summit of a high mountain and nearly surrounded by the highest summits. A small flat valley or gulch-like depression at the head of an alpine mountain drainage. Local in far West.

ARETE: A sharp, rocky crest; a comb-like secondary crest of rock which projects to a sharp angle from the side of a mountain. (Fr. origin.)

ARROYO: The channel of an intermittent stream steep cut in loose earth; a coulee. Local in Southwest. (Sp.)

ARTESIAN WELL: A well which has been excavated or drilled through impervious strata to a subterranean water supply which has its source at a higher level. The resulting hydrostatic pressure causes the water to rise in the bore to a sufficient height to overflow at the mouth of the well.

Atoll: A ring-shaped coral island nearly or quite encircling a lagoon.

Badlands: Waste or desert land deeply eroded into fantastic forms. Local in arid Northwest.

Bald: A high rounded knob or mountain top, bare of forest. Local in Southern States.

Bank: A low bluff margin of a small body of water; a mound-like mass of earth.

Bar: An elevated mass of sand, gravel or alluvium deposited on the bed of a stream or sea or lake, or at the mouth of a stream.

Barranca: A rock-walled and impassable canyon. Local in Southwest. (Sp.)

Barrier Beach: A beach separated from the mainland by a lagoon or marsh.

Barrier Island: A detached portion of a barrier beach between two inlets.

Base-level Plain: A flat, comparatively featureless surface or lowland resulting from the nearly completed erosion of any geographic area.

Basin: An amphitheater or cirque. Local in Rocky Mountains.

An extensive, depressed area into which the adjacent land drains, and having no surface outlet; the drainage or catchment area of a stream or lake. Use confined almost wholly to the arid West.

Bay: An indentation in the coast line of a sea or lake; a gulf.

Baygall: A swamp covered with growth of bushes. Local on south Atlantic coast.

Bayou: A lake or intermittent stream formed in an abandoned channel of a river; one of the half-closed channels of a river delta. Local on Gulf Coast. (Fr. origin.)

Beach: The gently sloping shore of a body of water; a sandy or pebbly margin of land washed by waves or tides.

Bed: The floor or bottom on which any body of water rests.

Bench: A strip of plain along a valley slope.

A small terrace or comparatively level platform on any declivity.

Bight: A small bay.

Bluff: A bold, steep headland or promontory.

A high, steep bank or low cliff.

Boca: A mouth; the point at which a streamway or drainage channel emerges from a barranca, canyon or other gorge, and debouches on a plain. (Sp.)

Bog: A small open marsh.

Bolson: A basin; a depression or valley having no outlet. Local in Southwest. (Sp., meaning "purse.")

Box Canyon: A canyon having practically vertical rock walls.

Bottom: The bed of a body of still or running water.

Bottom Land: The lowest land in a stream bed or lake basin; a flood plain.

Boulder: A rounded rock of considerable size, separated from the mass in which it originally occurred.

Branch: A creek or brook, as used locally in Southern States. Also used to designate one of the bifurcations of a stream as a fork.

Breaks: An area in rolling land eroded by small ravines and gullies. Local in Northwest.

Bridalveil-Fall: A cataract of great height and such small volume that the falling water is dissipated in spray before reaching the lower stream bed.

Brook: A stream of less length and volume than a creek, as used locally in the Northeast.

Brow: The edge of the top of a hill or mountain; the point at which a gentle slope changes to an abrupt one; the top of a bluff or cliff.

BUTTE: A lone hill which rises with precipitous cliffs or steep slopes above the surrounding surface; a small isolated mesa. Local throughout far West. (Fr. origin.)

CAJON: A box canyon. Local in Southwest. (Sp., meaning "box.")

CALA: A creek. Local in Southwest. (Sp.)

CAMA: A small upland prairie; a glade; a small park; a small, gently sloping prairie, partly wooded and surrounded by high mountain slopes. Local in Pacific Northwest. (Sp. meaning "bed.")

CAÑADA: A very small canyon. Local in Southwest. (Sp.)

CANAL: A sluggish coastal stream.

CANDELAS: A group of candle-like rocky pinnacles. Local in Southwest. (Sp.)

CANYON: A gorge or ravine of considerable dimensions; a channel cut by running water in the surface of the earth, the sides of which are composed of cliffs or series of cliffs rising from its bed. Local throughout the far West. (Sp. origin.)

CAPE: A point of land extending into a body of water; a salient of a coast.

CASCADE: A short, rocky declivity in a stream-bed over which water flows with greater rapidity and higher fall than over a rapid; a shortened rapid, the result of the shortening being to accentuate the amount of fall.

CATARACT: A waterfall, usually of great volume; a cascade in which the vertical fall has been concentrated in one sheer drop or overflow.

CAVE: A hollow space or cavity under the surface of the earth.

A depression in the ground; by abbreviation from a "cave in," as used colloquially.

CAVERN: A large, natural, underground cave or series of caves.

CAY: A key; a comparatively small and low coastal island of sand or coral. Local in Gulf of Mexico. (Sp. origin.)

CEJA: The cliff of a mesa edge; an escarpment. Local in Southwest. (Sp.)

CERRO: A single eminence intermediate between hill and mountain. Local in Southwest. (Sp.)

CERRITO or CERRILLO: A small hill. Local in Southwest. (Sp.)

CHANNEL: A large strait, as the British Channel; the deepest portion of a small stream, bay or strait through which the main volume or current of water flows.

CHASM: A canyon having precipitous rock walls.

CIENAGA: An elevated or hillside marsh containing streams. Local in Southwest. (Sp.)

CONE: A low, conical hill, built up from the fragmental material ejected from a volcano.

CIRQUE: A glacial amphitheater or basin. (Fr. origin.)

CLIFF: A high and very steep declivity.

CLOVE: A gorge or ravine. Local in Middle States. (Dutch origin.)

COAST: The land or the shore next to the sea.

COASTAL MARSH: One which borders a seacoast and is usually formed under the projection of a barrier beach.

COASTAL PLAIN: Any plain which has its margin on the shore of a large body of water.

CONTINENTAL SHELF: A comparatively shallow marginal ocean bed or floor bordering a continent; a submerged terrace bordering a continent.

CORDILLERA: A group of mountain ranges, including valleys, plains, rivers, lakes, etc.; its component ranges may have various trends, but the cordillera will have one general direction. (Sp. origin.)

COTEAU: An elevated, pitted plain of rough surface. Local in Missouri and neighboring States. (Fr. origin.)

COULEE: A cooled and hardened stream of lava. Coulees occur as ridges of greater or less length and dimensions, but rarely of great height. Local in Northwest.

A wash or arroyo through which water flows intermittently. Local in Northwest. (Fr. origin.)

COVE: A small bay.

An amphitheater or indentation in a cliff. It may be the abrupt heading of a valley in a mountain.

CRAG: A rough, steep or broken rock standing out or rising into prominence from the surface of an eminence; a rocky projection on a cliff or ledge.

CRATER: The cup-shaped depression marking the position of a volcanic vent; its margin is usually the summit of the volcano.

CREEK: A stream of less volume than a river.

A small tidal channel through a coastal marsh.

CREST: The summit land of any eminence; the highest natural projection which crowns a hill or mountain.

CUESTA: An ascending slope; a tilted plain or mesa top. Local in Southwest. (Sp.)

CURRENT: A continuous movement or flow, in one direction, of a body of water; a stream in or portion of an ocean which has continuous motion or flows in one direction.

DALLE: A rapid. (Fr. origin.)

DECLIVITY: A descending slope, as opposed to acclivity.

DEFILE: A deep and narrow mountain pass.

DELTA: The mouth of a river which is divided down stream into several distributaries.

DEPRESSION: A low place of any dimensions on a plain surface; the negative or correlative of elevation or relief.

DESERT: An arid region of any dimensions, barren of water other than in occasional flood streams or springs; frequently covered with considerable growths of cacti, coarse bunch grass, mesquite and other shrubs. A desert is not necessarily a plain surface, as most deserts are broken by the sharp escarpments and buttes which are common to the arid regions; by sand dunes or volcanic ejecta. A desert may include canyons and mountains of considerable differences of elevation.

DIKE: A ridge having for its core a vertical wall of igneous rock.

DIVIDE: The line of separation between drainage systems; the summit of an interfluve.

The highest summit of a pass or gap.

DOME: A smoothly rounded rock-capped mountain summit. Local in the Sierra Nevada.

DRAFT: A draw.

DRAW: A very shallow and small gorge, gulch or ravine; the eroded channel through which a small stream flows.

DRIFT: A slow, great ocean current.

DRUMLIN: A smooth, oval or elongated hill or ridge composed chiefly of glacial detritus.

DRY WASH: A wash, arroyo or coulee, in the bed of which is no water.

DUNE: A hill or ridge of sand formed by the winds near a sea or lake shore, along a river-bed or on a sandy plain.

Eminence : A mass of high land.

Escarpment : An extended line of cliffs or bluffs.

Esker : A long, winding ridge of sand or gravel; the deposit from a stream flowing beneath a glacier.

Everglade : A tract of swampy land covered mostly with tall grass. Local in South.

Fall : A waterfall or cataract ; the flow or descent of one body of water into another.

Fan : A mountain delta ; a conical talus of detrital material.

Fiord : A narrow inlet with high, rocky walls. A glacial gorge filled by an arm of the sea.

Flat : A small plain usually situated in the bottom of a stream gorge ; often applied to a small area of tillable land in the bend of a bluff-walled stream.

Floodplain : Any plain which borders a stream and is covered by its waters in time of flood.

Floor : The bed or bottom of the ocean ; a comparatively level valley bottom.

Fly : Corrupted from Vly ; local in Adirondacks of New York.

Foot : The bottom of a slope, grade or declivity.

Foothill : One of the lower subsidiary hills at the base of a mountain.

Fork : One of the major bifurcations of a stream ; a branch.

Fountain : A flow of water rising in a jet above the surrounding surface. Artesian wells, geysers and springs may be fountains.

Fumarole : A spring or geyser which emits steam or gaseous vapor ; found only in volcanic areas. (Ital.)

Gap : Any deep notch, ravine or opening between hills or in ridge or mountain chain.

Geyser : A hot spring, the water of which is expelled with steam in an accumulated volume in paroxysmal bursts.

Glacier : A permanent body or stream of ice having motion.

Glacial Gorge : A deeply cut valley of V-shaped cross-section, the result of glacial erosion.

Glacial Lake : One, the basin of which has been carved by glacial action ; a lake dammed on one side by glacial detritus.

Glade : A grassy opening or natural meadow in the woods ; a small park. In western Maryland, applied to a brushy, grassy, or swampy opening in the woods.

Gorge : A canyon ; a rugged and deep ravine or gulch.

Grade : A slope of uniform inclination.

Grotto : A small, picturesque cave.

Gulch : A small ravine; a small, shallow canyon with smoothly inclined slopes. Local in far West.

Gulf : A gorge or deep ravine ; a short canyon. Local in Southern mountains and New York.

A bay, usually of great dimensions.

Gully : A channel cut by running water ; less than a gulch or ravine.

Gut : A narrow passage or contracted strait connecting two bodies of water.

Hanging Valley : A high glacial valley, tributary to a more deeply eroded glacial gorge or fiord.

Headland : A promontory.

Height of Land : The highest part of a plain or plateau ; or, on a highway, a pass or divide. Local in Northeast and British America.

Highland : A relative term denoting the higher land of a region ; it may include mountains, valleys, and plains.

HILL: An eminence less than a mountain, rising above the surrounding land.

HOGBACK: A steep-sided ridge or long hill; used to describe a group of sharply eroded low hills.

In the far West a steep foothill, having parallel trend to the associated mountain range.

HOLE: A small bay, as Wood's Hole, Mass. Local in New England.

HOLLOW: A small ravine; a low tract of land encompassed by hills or mountains.

HOOK: A low, sandy peninsula terminating in curved or hook-shaped end forming a bay.

HOT SPRING: A spring, the water of which has a temperature considerably above that of its surroundings.

HUERFANO: A solitary hill or cerro. Local in Southwest. (Sp., meaning "Orphan.")

INLET: A small narrow bay or creek; a small body of water leading into a larger.

INTERFLUVE: The upland separating two streams having approximately parallel course.

ISLAND: An area of land entirely surrounded by water. In dimensions islands range from a point of rock rising above the surface of the water to an area of land of continental dimensions, as Australia.

ISTHMUS: A narrow strip of land connecting two considerable bodies of land.

KAME: A small hill of gravel and sand made by a glacier.

KETTLE HOLE: A steep-sided hole or depression in sand or gravel; a hole in the bottom of a stream or pond.

KEY: A cay, as the Florida Keys.

KILL: A creek. Local in Middle States. (Dutch origin.)

KNOB: A prominent peak with rounded summit. Local in Southern States.

KNOLL: A low hill.

LAGOON: A shallow bay cut off from a sea or lake by a barrier; often stagnant with ooze bottom and rank vegetation. It may be of salt or fresh water. Local in South and Southwest. (Sp. origin.)

LAKE: Any considerable body of inland water.

LANDSLIDE: Earth and rock which has been loosened from a hillside by moisture or snow, and has slid or fallen down the slope.

LANDSLIP: A landslide of small dimensions.

LATERAL MORAINE: A moraine formed at the side of a glacier; usually ridge-like in shape.

LEDGE: A shelf-like projection from a steep declivity; a rocky outcrop or reef.

LENTICULAR HILL: A short drumline.

LITTORAL: That portion of a shore washed by, or between high and low water.

MALPAIS: A badland. Local in Northwest. (Fr.)

MARSH: A tract of low, wet ground, usually miry and covered with rank vegetation. It may at times be sufficiently dry to permit of tillage or of having hay cut from it. It may be very small and high on a mountain, or of great extent and adjacent to the sea.

MEADOW: A bit of natural grassland in wooded mountains; a glade or small park. Local in far West.

MESA: A tableland; a flat-topped mountain bounded on at least one side by a steep cliff; a plateau terminating on one or both sides in a steep cliff. Local in Southwest. (Sp. origin.)

MESITA: A small mesa. Local in Southwest. (Sp.)

MIRE: A small, muddy marsh or bog.

MONADNOCK : An isolated hill or mountain rising above a peneplain, after the removal by erosion of its surrounding features.

MONUMENT : A column or pillar of rock. Local in Rocky Mountain region.

MORAINE : Any accumulation of loose material deposited by a glacier.

MORASS : A swamp, marsh or bog having rank vegetation and muddy or offensive appearance.

MOUND : A low hill of earth.

MOUNTAIN CHAIN : A series or group of connected mountains having a well defined trend or direction.

MOUNTAIN : An elevation of the surface of the earth greater than a hill and rising high above the surrounding country.

MOUNTAIN RANGE : A short mountain chain ; a mountain much longer than broad.

MOUNTAIN SYSTEM : A cordillera.

MOUTH : The exit or point of discharge of a stream into another stream or a lake or sea.

MUSKEG : A bog or marsh. Local in Northwest and British America.

NECK : The narrow strip of land which connects a peninsula with the mainland.

NÉVÉ : The consolidated granular snow on a mountain summit in which glaciers have their source.

NOTCH : A short defile through a hill, ridge or mountain.

NUNATAK : A rock island in a glacier.

OCEAN : The great body of water which occupies two-thirds of the surface of the earth. The sea as opposed to the land.

OCEANIC PLATEAU : An irregularly elevated portion of the ocean bed, of considerable extent and perhaps rising in places above the water surface.

OUTLET : The lower end of a lake or pond; the point at which a lake or pond discharges into the stream which drains it.

PAHA : A long ridge of fine, loamy material deposited from a stream which has cut a channel in a melting glacier. Local in Iowa and vicinity. (Indian.)

PALISADE : A picturesque, extended rock cliff rising precipitately from the margin of a stream or lake, and of columnar structure.

PARK : A grassy, wide, and comparatively level open valley in wooded mountains. Local in Rocky Mountains.

PASS : A gap or other depression in a mountain range through which a road or trail may pass; an opening in a ridge forming a passageway. A narrow, connecting channel between two bodies of water.

PEAK : A pointed mountain summit; a compact mountain mass with single conspicuous summit.

PENEPLAIN : A land surface which has been reduced to a condition of low relief by the erosive action of running water.

PENINSULA : A body of land nearly surrounded by water.

PICACHO : A peaked butte. Local in Southwest. (Sp.)

PINNACLE : Any high tower or spire-shaped pillar of rock, alone or cresting a summit.

PITTED PLAIN : A plain of gravel or sand with kettle holes.

PLAIN : A region of general uniform slope, comparatively level, of considerable extent and not broken by marked elevations and depressions; it may be an extensive valley floor or a plateau summit.

PLATEAU : An elevated plain. Its surface is often deeply cut by stream channels, but the summits remain at a general level. The same topographic form may be called a plain and a plateau, and be both. An elevated tract of considerable size and diversified surface. (Fr.)

PLAYA: An alkali flat; the dried bottom of a temporary lake, without outlet. Local in Southwest. (Sp. origin.)

A small area of land at the mouth of a stream and on the shore of a bay; an alluvial flat coast land as distinguished from a beach. Local in Southwest. (Sp.)

PLAYA LAKE: A shallow, storm-water lake. When dried it forms a playa. Local in Southwest. (Sp. origin.)

PLAZA: An open valley floor; the flat bottom of a shallow canyon. (Sp.)

POCOSON: A swamp. Local on South Atlantic coast. (Indian.)

POINT: A small cape; a sharp projection from the shore of a lake, river, or sea.

POND: A small, fresh-water lake.

POOL: A water-hole or small pond.

POTHOLE: A basin-shaped or cylindrical cavity in rock, formed by stone or gravel gyrated by eddies in a stream.

PRAIRIE: A treeless and grassy plain.

PROMONTORY: A high cape with bold terminations; a headland.

PUERTA: A pass or defile through an escarpment or sierra. Local in Southwest. (Sp. meaning "gate.")

QUAGMIRE: Any mire or bog.

QUEBRADA: A canyon of rugged aspect; a fissure-like ravine or canyon. Local in Southwest. (Sp.)

RAPID: Any short reach of steep slope between two relatively quiet reaches in a stream-bed. The water over a rapid flows with greater velocity than in adjacent portions of a stream.

RAVINE: A gulch; a small gorge or canyon, the sides of which have comparatively uniform slopes.

REEF: A ridge of slightly submerged rocks.

A ledge of rock.

RELIEF: Elevation as opposed to depression; the elevated portions of the land surface.

RIDGE: The narrow, elongated crest of a hill or mountain. An elongated hill.

RIFFLE: The shallow water at the head of a rapid; a rapid of comparatively little fall.

RIFT: A narrow cleft or fissure in rock.

RILL: A very small trickling stream of water, less than a brook.

RINCON: Corner or cove; the angular indentation in a mesa edge or escarpment in which a canyon heads. Local in Southwest. (Sp. origin.)

RIO: A river. Local in Southwest. (Sp. origin.)

RIVER: A large stream of running water. A stream of such size as to be called a river in one locality may be called a creek or brook in another.

ROCK CAVE: A shelter cave.

ROLLING LAND: Any undulating land surface; a succession of low hills giving a wave effect to the surface.

RUN: A brook or small creek. Local in South.

SALIENT: An angle or spur projecting from the side of the main body of any land feature.

SAND DUNE: Any dune.

SANDIA: An oblong, rounded mountain mass. Local in Southwest. (Sp., meaning "watermelon.")

SCARP: An escarpment.

SEA: A large body of salt water.

SEEP: A small, trickling stream. Local in Southwest.

SERRATE: The rocky summit of a mountain having a sawtooth profile; a small sierra-shaped ridge. Local in Southwest. (Sp.)

Shelter Cave: A cave only partially underground, which is formed by a protecting roof of overlying rock; generally open on one or more sides.

Shoal: A shallow place in a stream or lake; an elevated portion of the bed of a stream, lake, or sea, which rises nearly to the water surface; a bar.

Shore: The land adjacent to any body of water.

Sierra: A rugged mountain range with serrate outline. Local in Southwest and Pacific States. (Sp. origin.)

Sink: The bottom of an undrained basin.

Slide: The exposed surface left in the trail of a landslide; the place whence a landslide has departed. Local in Northeast.

Slope: The inclined surface of a hill, mountain, plateau, or plain or any part of the surface of the earth; the angle which such surfaces make with the level.

Sound: A relatively shallow body of water separated by an island from the open sea and connected with it at either end so that through it there is clear tidal flow.

Spit: A low, sandy point or cape projecting into the water; a barrier beach.

Spring: A stream of water issuing from the earth.

Spur: A sharp projection from the side of a hill or mountain; a radial ridge of subordinate dimensions.

Stillwater: Any reach in a stream of such level inclination as to have scarcely any perceptible velocity of flow; a sluggish stream, the water of which appears to be quiet or still. Local in Northeast.

Strand: The shore or beach of the ocean or a large lake.

Strait: A relatively narrow body of water connecting two larger bodies.

Stream Channel: The trench or depression washed in the surface of the earth by running water; a wash, arroyo, or coulee.

Stream: Any body of flowing water. It may be of small volume, as a rill, great as the Mississippi or mighty as the Gulf Stream in the Atlantic Ocean.

Sugarloaf: A conical hill comparatively bare of timber. Local in far West.

Summit: The highest point of any undulating land, as of a rolling plain, a mountain or a pass in a mountain.

Swale: A slight, marshy depression in generally level land.

Swamp: A tract of stillwater abounding in certain species of trees and coarse grass on boggy protuberances.

Table: An elevated, comparatively level bit of land between two streams. Local in Northwest.

Table Land: A mesa.

Table Mountain: A mountain having comparatively flat summit and one or more precipitous sides. A mesa.

Talus: A collection of fallen disintegrated material which has formed a slope at the foot of a steeper declivity.

Tank: A pool or water-hole in a wash. Local in arid West.

Terminal Moraine: A moraine formed across the course of a glacier, irregularly ridge-like in shape.

Terrace: A relatively narrow level space or bench on the side of a slope and terminating in a short declivity.

Terrain: See Terrane.

Terrane: An extent of ground or territory; a portion of the surface of the earth. (Fr.)

Terrene: Pertaining to the earth.

Teton: A rocky mountain-crest of rugged aspect. Local in Northwest. (Fr.)

THALWEG: A watercourse; a valley bottom; the deepest line or part of a valley sloping in one direction. (Ger.)

TIDAL MARSH OR FLAT: Any marsh or flatland which is wetted by a tidal stream or sea.

TONGUE: A narrow cape.

TOWER: A peak rising with precipitous slopes from an elevated table land. Local in Northwest.

TUNDRA: An upland or alpine marsh, the ground beneath which is frozen. There are great areas of tundra in the Arctic. (Russ.)

UPLAND: A highland.

VALLEY: A depression in the land surface generally elongated and usually containing a stream.

VLEI: See Vly.

VLY: A small swamp, usually open and containing a pond. Local in Middle Atlantic States. (Dutch origin.)

VOLCANO: A mountain which has been built up by the materials forced from the interior of the earth, piling about the hole from which they were ejected. These may be lava, cinders or dust.

VOLCANIC NECK: The solid material which has filled the throat or vent of a volcano, and has resisted degradation better than the mass of the mountain. It thus finally stands alone as a column or crag of igneous rock.

WASH: The broad, dry bed of a stream; a dry stream channel. Local in arid West.

WATERFALL: Any single cataract, Both the terms, waterfall and cataract, may be applied to falls of like magnitude.

WATER GAP: A pass through a mountain occupied by an existing stream.

WATERSHED: The ridge of high land or summit separating two drainage basins; the summit of land from which water divides or flows in two or more directions; the area drained by a stream.

WELL: Any excavation in soil or rock which taps underground water.

WIND GAP: An elevated gap not occupied by a watercourse.

NOTES ON CLIMATOLOGY.

BY

ROBERT DeC. WARD.

The Plague and Climatic Conditions.—At the December meeting of the Royal Meteorological Society (London), Mr. Baldwin Latham, M.Inst. C.E., read a paper on *The Climatic Conditions necessary for the Propagation and Spread of Plague.* Mr. Latham believes that the bubonic plague, which is primarily due to a specific organism or microbe so small that probably 250 millions of them would be required to cover a square inch of surface, is greatly influenced by pestilential emanations from polluted and water-logged soils. The author gives accounts of various outbreaks of plague in England and other countries, including the great plague of London in 1665, when 7,165 deaths were recorded in one week in September. Plague is undoubtedly a disease of the poor, and attacks most readily those living on low diet. That the ground itself exercises an influence upon plague is shown by the fact that, in all the epidemics, persons living on the ground floors suffer to a much greater extent than those living on the upper floors of houses. Mr. Latham says that there can be no doubt that the conditions which ordinarily produce evaporation from water or land surfaces are identical with those which produce exhalations from the ground, and these exhalations consist largely of vapor of water, carrying matters injurious to health. The author has discussed the meteorological observations (including the temperature of the soil at depths of 9, 20, 60 and 132 inches) made at the Colaba Observatory, Bombay, and has compared them with the number of deaths from plague during the recent epidemics in Bombay. He says that if the temperature of the air increases beyond the temperature of the ground, so that its dew-point is above the temperature of the ground, condensation takes place instead of evaporation. To this increased high temperature may be due the sudden stoppage of plague after a certain high temperature has been reached, which, by raising the temperature of the dew-point, stops all exhalation from the ground and may cause condensation to take place instead of evaporation. So also a sudden fall of temperature causes plague to arise, for a fall of temperature means that the temperature of the dew-point must fall, and the tensional difference between a low dew-point and a high ground temperature would at once lead to exhalations from the ground, and so to the liberation of the plague bacillus from the ground, accompanied by the exhalations necessary for its development.

This question of the relation between the plague and climatic conditions, one aspect of which is considered in Mr. Latham's paper, is one which is by no means settled. While it used to be thought that the plague could not occur in the Torrid Zone, it is now known, in view of outbreaks of the disease within the tropics in Arabia and India, that this rule does not hold rigidly. In Egypt the autumn seems to be the season in which the plague appears, and June the month in which it dies out. In Europe, outside of Turkey, the plague season has been summer and autumn. In India no direct connection with the seasons could be detected in the epidemics of 1815–21 (the first outbreak concerning which we have trustworthy information) and of 1836–38. From all the data at hand, the general conclusion is that a moderately high temperature favors the development and extension of the plague, but extremes of heat and cold are unfavorable to its breaking out. Exceptions to this rule are many. For instance, in the epidemic at Smyrna, in 1735, the heat was so excessive during the plague that many of the people who left the town for neighboring villages died of sunstroke on the way; while in Roumelia, in 1737–38, the plague continued in many places in which the temperature fell at times to 3° Fahr. Regarding the effect of atmospheric moisture there is also some doubt. Some authorities hold that a high degree of humidity is necessary for the epidemic extension of the plague, while others maintain the opposite view. Certainly the occurrence of many outbreaks at high altitudes in Kurdistan, Arabia, China and India makes it clear that a moist atmosphere is not always an essential in the spread of the epidemic. Again, in the present outbreak of plague in India, a station at an altitude of 14,000 feet in Russian Turkistan has been visited by the disease, and over one-half of the inhabitants died before medical assistance was sent there. At this place, Augzap, the climate is both cold and dry, and very different from the hot, moist climates near sea-level.

THE RAINY SEASON CAMPAIGN IN THE PHILIPPINES.—In the *Journal of School Geography* for December an article by R. DeC. Ward discusses the climate of the Philippine Islands, and calls attention to some of the more important relations of these climatic conditions to man. It is inevitable that so strong a contrast between different parts of the year as that between the rainy and dry seasons in the Philippines should exercise marked controls over the customs, occupations and general conditions of life of the inhabitants of the islands. In this connection the article referred to says:

"Our chief interest in this seasonal control over human activities in the Philippines has, since last May, been centered in the bearing of the past rainy season upon the military campaign which our troops have been carrying on in those new possessions of ours. Anyone with even the vaguest ideas as to what a tropical rainy season is, would certainly never have expected that an active aggressive military campaign could be carried on by white troops during the months from June to October. Yet under date of May 29th last, a press despatch from Manila, printed in all our leading newspapers, made the emphatic statement that the commanding general at Manila 'says the campaign against the Filipino insurgents will be prosecuted by the American forces with the utmost aggressiveness possible during the rainy season. We will show the insurgents by vigorous action on the rivers, lakes and mountains that their belief that we cannot campaign in the rainy season or in the mountains is untrue.' That this proposed active campaign has not been carried out everyone who has read our newspapers through the past summer knows full well.

"The difficulties that have beset our troops in the Philippines since the beginning of the rains are now familiar to Americans. With the roads deep in mud or overflowed with water, so that marching became extremely difficult, if not altogether impossible, the sufferings of the men under the oppressive moist heat were surely terrible. Cases of prostration by the heat and of sunstroke were very frequent, far more so than the strict censorship of the press at Manila has led people here to suppose. In one press despatch it was said (April 28th): 'If the American troops were not fighting the heat as well as the rebels, they might pursue the natives until they compelled them to scatter in the mountains, but the soldiers are so wilted that they must rest.' The buffaloes used to drag the guns and camp wagons succumbed to the heat in large numbers. After a day's march in drenching rains, through mud so deep and so sticky that it was often impossible to pull their legs out after taking a step, and with water up to their waists, our men frequently had advanced but seven or eight miles, or at the rate of about one mile an hour. The Manila correspondent of the *Army and Navy Journal* (New York), in a letter published July 8th, says: 'The rain has been falling almost continuously. The whole country is flooded. The trenches at San Fernando are ditches of water and the mud is knee-deep in the temporary camps at several of the outlying towns.' The same writer in a letter published July 22d, says: 'Manila resembles an Arkansas town after a spring freshet. The heavy rains, which have amounted thus far to more than 30 inches in July, have converted the streets into waterways, and boats have been doing a merry commerce from street to street. Where a few days ago was heard the booted foot-fall of the American sentry, arises the splash of paddle and oar. The surrounding country is equally flooded, and the American soldier now knows what camnpaigning in a rainy season means.'

"These quotations must suffice to give a general idea of the conditions under which troops have to live during a Philippine rainy season. That an aggressive campaign cannot be carried on under these conditions is perfectly clear. Even the Army officers themselves, who boasted of their ability to proceed just the same in the summer months as in the winter, have now been compelled to acknowledge their mistake. It is interesting, in connection with the press despatch of May 29th, above referred to, to note that the *Army and Navy Journal* for October 14th, p. 139, says: 'No one expected much activity * * * * during the rainy season.'"

METEOROLOGY OF HAVANA IN 1898.—The following data relating to temperatures and rainfall at Havana during the year 1898 have been compiled for these NOTES from the *Observaciones Magnéticas y Meteorológicas del Observatorio del Colegio de Belen de la Compañia de Jesus en la Habana, Año de 1898.*

Mean monthly temperatures: January, 72.3°; February, 70.0°; March, 73.0°; April, 75.7°; May, 77.9°; June, 80.6°; July, 81.0°; August, 80.6°; September, 80.4°; October, 78.1°; November, 76.5°; December, 72.5°.

Mean annual temperature: 76.5°. Absolute maximum temperature: 91.4°, in August. Absolute minimum temperature: 54.0°, in January.

Mean relative humidity: 74.7%. Maximum monthly relative humidity: 82% in October. Minimum monthly relative humidity: 67.9%, in March.

Monthly rainfall: January, 0.02 in.; February, 2.02 in.; March, 1.06 in.; April, .86 in.; May, 1.38 in.; June, 2.95 in.; July, 5.79 in.; August, 6.74 in.; September, 5.63 in.; October, 11.20 in.; November, 1.87 in.; December, .24 in. Total rainfall for the year: 39.76 in.

Comparing these data for 1898 with the means derived from 10 years' observations, 1888–1897, by Prof. H. A. Hazen, it appears that the year 1898 had very nearly the average annual temperature. The warmest month, July, was 1.4° cooler than the average for that month, and the coolest month was February, with 70.0°, whereas January is usually the coolest, with a mean of 70.3°. The annual rainfall in 1898 was about 12 inches less than the average rainfall based on the 10 years' record.

THE WEATHER AND THE DAIRY.—A point of some economic importance in connection with the effect of our winter cold upon the amount and quality of the milk given by cows has recently been noted in the *Monthly Weather Review* of the U. S. Weather Bureau. In general, it appears that there is a decided diminution in the yield of milk and in the cream as soon as the weather turns cold. The practice of some dairymen of keeping their barns artificially heated during the cold weather thus finds abundant justification. Furthermore, the practice of allowing cattle to stay in the fields or open pens all night during the winter months is productive of great loss to the farmers of the Southern States. The food given to the animals goes first of all towards the maintenance of life and animal heat, and the surplus only goes to the production of increased flesh and milk. A fall in temperature cuts off this surplus. Some records made at a Texas station during a "Norther" show that the first effect of the cold was to increase the yield of butter, but the continued effect was to decrease both butter and milk by 20%, and the cows did not recover for several days after the cold weather. If ice-cold water is given to cows, there is a fall of 6% to 8% in the yield of milk as compared with that when the drinking water is warm. This subject has lately been studied by Mr. E. A. Evans, of the Virginia State Weather Service, the results of whose investigations have been summarized in the foregoing statements.

NOTES ON ANTHROPOLOGY.

BY

ROLAND B. DIXON.

THE ARYAN QUESTION.—There are few subjects which have been more discussed during the last thirty or forty years than the various questions in regard to the origin and migrations of the Aryan race. The earlier period of purely philological investigation has given way to a general study of all the aspects of the matter, and new theories of the most opposite character have been developed. One of the most recent works on this subject is the forthcoming one of Lapouge, the introductory chapter of which has recently been published in the *American Journal of Sociology* (Nov., 1899, pp. 329–347). In this, which is in some measure a résumé of the whole work, he declares that although there was probably no such thing as an "Aryan race," yet there must have been a dominant type among the various types that spoke Aryan languages, and that this dominant type, which was responsible for much, if not most, of the civilization of the European peoples, was the dolichocephalic blond. The history of the Aryan controversy is briefly reviewed, in order to show the change of opinion from the earlier theories of the original unity of the Indo-Germanic peoples, and the development of the different languages by the hiving off of successive groups of the postulated primitive Aryans, to the later views that Sanscrit and Zend were not the oldest-known forms of the whole group of languages, and that the origin of these was rather to be ascribed to the "collective evolution" of the languages of a group of nomad or semi-nomad tribes, whose languages had originally been more or less closely related. In this process each dialect would necessarily influence its geographical neighbors; in the course of time the stronger would eliminate the weaker; and the present languages, related collaterally rather than by direct descent, would be thus produced. Since the relations between the different languages more or less closely correspond to their present geographical positions, Lapouge thinks it possible that the peoples speaking the different languages to-day may always have been neighbors as at present, and that the Aryan civilization and language therefore developed in Europe. From this point of view, there can be no distinct "Aryan type," as the Aryan civilization and language were both the result of the coalescing of several types. In his opinion, however, the major part of the civilization is to be attributed to a dominant type, and this, he thinks, must have been the "dolicho blond." The brachycephalic peoples, whose remains are found associated sometimes with the dolicho blonds, were, Lapouge considers, the slaves or serfs of the latter.

This theory will doubtless be attacked by the holders of other views. It is difficult to see where the positive proof is found that the dolichocephalic type was also blond. Ripley, in summing up the opinions of various writers, although showing that there is little uniformity in their views, yet advances very plausible arguments to prove that this same dolichocephalic type was brunet or africanoid in character;—definite proof, however, seems almost impossible.

TOTEMISM.—A flood of new light has been thrown on this hitherto rather obscure subject by the splendid work of Spencer and Gillen on the "Native Tribes of Central Australia" (London, 1899), to which attention has been called by Frazer (*Journal Anthrop. Inst.*, new series I; pp. 281–6). Among the Arunta and other neighboring tribes the institution differs markedly from that found elsewhere in Australia and other parts of the world. As a rule, we find that the different totemic groups into which many tribes are divided are exogamic;—each member must marry outside his or her own totem, and this is the case even where the tribe is subdivided into other divisions unconnected with the totemic grouping. In the Arunta, however, the various totemic groups are not exogamic. The whole tribe is divided into two moieties, each of which again is divided into two, so that there are four classes, of which the Panunga and Bulthara together constitute the first moiety, and the Kumara and Purula the second. A member of any one of these four classes is bound to marry into a certain one of the opposite moiety, as, for example, a Panunga marries a Purula, and vice-versa. But each individual, besides being a member of one of these four classes, is by birth a member of some totemic group. In other tribes these totemic groups are each confined to one moiety or class, that is, all the men and women of the Wild-cat totem belong to a single class, so that in marrying they always marry a member of some other totem. Here, however, the situation is different. A man belongs to a certain totem because he was born in a certain region which is closely associated with some animal or plant ancestor, and all men or women born, or, rather, conceived within this particular region, belong to the same totem. Members of the same totem may therefore be found in all the classes, and the totems cease on that account to be exogamic.

The second point of great interest in the totemic system of these Arunta natives is the peculiar "localization" of the totem. As already stated, the child takes its totem from the particular region in which it was conceived; the explanation of this custom is as follows. In the distant past certain persons lived in the same region which the Arunta inhabit to-day. These individuals were in character half men and half animal, and were in a way the ancestors of the present tribe. At various places throughout the region these people "entered the earth" or buried certain sacred stones, known as Churinga, and there, with those stones or in some natural feature of the landscape, their spirit parts remained. These spirit individuals are constantly on the watch for opportunities to be born, and enter into women who pass near their abode, and are born as children. These, since they are virtually reincarnations of the Alcheringa individuals (as the people of the past are called) naturally take as their totem that which was the totem of the Alcheringa individual whose reimbodiment they are. Thus, if a child is conceived in a locality in which, according to tradition, a Wild-cat man of the Alcheringa buried Churinga, he belongs to the Wild-cat totem. This being the method by which each individual receives his or her totem, it follows that the different children of one couple may each have a different totem;—a condition almost without a parallel among other tribes where the totemic system prevails.

Perhaps of greater interest than either of the foregoing is the portion of the book devoted to an exposition of the ceremonies which each totem is in the habit of performing. These are, in brief, for the purpose of increasing the supply of the particular animal which is the totem of the group. Thus the Kangaroo totem performs ceremonies, the object of which is to increase the supply of kangaroos; the Bakea-flower totem performs other ceremonies to insure a plentiful crop of bakea-flowers, etc. Moreover, the members of the Kangaroo totem are not forbidden to eat kangaroo, as is generally the case with any totemic group. On the contrary, they may eat of it sparingly, and at times are obliged to eat it;—if they did not they would be unable to perform the ceremonies satisfactorily. The same holds true of all other totems. In early days, according to the traditions, there was no restriction as to how much one should eat, and apparently the members of the totem then had first right to the animals whose name they bore. To-day they eat but little, but aid others to capture and kill the animal. These facts, taken in connection with the regulations as to marriage, etc., seem to show that in Central Australia, at least, the function of the totemic group was primarily to increase the supply of its own peculiar animal or plant, or if it was a group like the Water totem, to cause rain in time of drought;—its sociologic function, in regulating marriage by dividing the tribe into a series of exogamic groups, is here secondary, and in the Arunta, at least, entirely absent.

It is difficult to say too much in praise of the work done by Professor Spencer and Mr. Gillen. They have produced what is probably the most complete and perfect record of the sacred rites and ceremonies of any tribe of savage men, and apart from the extreme value of the facts they have recorded, their work must stand as a pattern for many years to all other investigators along the same line.

ORIGIN OF GENDER.—Mr. J. G. Fraser, in the *Fortnightly Review* for January (pp. 79–91), presents a theory of the origin of grammatic gender which is, in many ways, quite novel. The theory which he offers is that, at least in part, grammatic gender is due to the marriage of men of one tribe with women belonging to another. A man and his wife would then speak different languages, and each would have their own words for all objects. In time these two languages would, according to the theory, become more or less amalgamated, especially if, as might be possible, the men and women both belonged to the same linguistic stock. In this case, the difference in vocabulary would be chiefly in form and pronunciation, and not an absolute difference. It is assumed that in time these two dialects or languages would tend to become confounded; the proper dialect of each tribe would be spoken less and less correctly, and finally, by elision and otherwise, the duplicate forms would be lost, and only a single one survive. If, in this struggle for existence and "survival of the fittest," the term which finally remained was one that had been used by the men, the word would be of the masculine gender; if, on the other hand, it had been in use by the women, it would become of the feminine gender. Disregarding Mr. Fraser's further remarks on the subject of "Subjective and Objective Gender," a word or two might be said in regard to the theory just outlined. It seems, in the first place, very unlikely that there should have been so general a marrying between tribes speaking different languages. Again, if this theory is true, it would follow that there would be no regularity in the genders of nouns. While it is true that in many cases there is little assignable cause for the gender of inanimate objects (to which this theory especially applies), yet they can often be grouped into classes with more or less regularity;—which would not be possible were the gender of an object determined by chance alone. Furthermore, gender is not, in general, a difference in the words so much as a distinction between them by means of some suffix or prefix, the root or stem remaining the same. It seems also rather problematical whether masculine and feminine gender could be developed respectively from the words used by the men and women; and the further fact remains that in a large number of languages there is no sex gender at all, the distinction being made rather between animate and inanimate, or on some other basis. In these cases, at least, the theory does not appear applicable

PHYSIOGRAPHIC NOTES.

BY

RALPH S. TARR.

GEOLOGY AND PHYSICAL GEOGRAPHY OF JAMAICA.—For a number of years Prof. Robert T. Hill has been investigating the interesting phases of the geology and geographical development of Central America and the West Indies. His latest contribution—a well-illustrated report upon the Island of Jamaica (*Bulletin*, *Museum Comparative Zoology*, XXXIV., 1899, pages 1–256)—gives a concrete statement of the geographical development of this island and its relation to the other islands of the West Indies and the neighboring mainland.

Jamaica lies in "almost the exact center of the great Mediterranean," being about 65 miles south of eastern Cuba and almost due west of Haiti. Between Cuba and Jamaica the ocean descends to a depth of fully 18,000 feet, and the island itself rises, in its highest peaks—those of the Blue Mountains—to an altitude of 7,360 feet. On the island there are four great groups of rocks: (1) the oldest—a series of stratified and volcanic rocks, greatly displaced and deformed; (2) a series of marls and limestones of oceanic origin; (3) a variety of igneous rocks, penetrating the first and second, and, therefore, younger than either; and (4) more recent deposits of ocean marls and coral reef rocks.

The geologist will find many interesting details in this report, especially the discussion of the extensive deposits of limestone and the consideration of the various causes for the formation of these rocks,—a subject usually treated with great brevity.

The geographer will find here an interesting statement not only of the development of Jamaica, but of its relation to past changes in the West Indian-Central American region. According to Hill, the known history of Jamaica begins in the latter Cretaceous time, during which volcanic action was in progress. There then followed an extensive degradation, during which the high pre-existing land, covered with vegetation, was deeply worn and great beds of sediment were assorted and deposited in shallow waters. Subsidence accompanied this deposition, and this was closely followed by folding of the strata through the Miocene, during which the rocks were closely flexed and even completely overthrown. There then followed a deep subsidence, reaching certainly more than 7,000 feet, during which beds of deep-sea ooze were accumulated, and most, if not all of Jamaica was lowered beneath the sea. Then came an uplift, which not only restored the former land area, but extended it far beyond its present outline, connecting it with the adjacent island of Haiti on the east and possibly the Central American region to the southwest. This emergence was dominated by a low east and west folding, which caused the present elongate shape of Jamaica, and accompanying it was a great intrusion of igneous rock from below. The next stage in the history of the island was a renewal of the subsidence, which was succeeded by another upward movement, accompanied by slight deformation, and both accompanied and followed by great erosion. The next and last event was the general elevation, or, perhaps better, series of elevations, which have continued until the present time, restoring to the island the belt of land now forming the fringing coastal border and raising numerous coral reefs above the sea. The latter are now found, in the form of terraces of reef rock, at altitudes of 60, 25 and 15 feet.

The old idea, propounded by Humboldt, and followed in many books to the present day, that the formation of the Rocky Mountains and the Andes was not only contemporaneous, but continuous, is once more attacked by Hill. He points out again the fact that the Central American region shows no connecting ranges, but, on the contrary, east and west trends to the folds, the Central American region being rather a part of the West Indian than of the Andean and Rocky Mountain series. He also controverts the doctrine proposed by Spencer, and which many geologists have considered exceedingly doubtful, that the irregularities of the ocean bottom topography of the great American Mediterranean were due to submerged lands,—a kind of lost continent, an American Atlantis. The facts that Hill brings forward seem to prove conclusively that this topography is not due to erosion, but to orogenic causes.

While the general problem of the relation of Jamaican geological history to that of the entire West Indies is touched upon, it is presumed that Prof. Hill will later develop this relationship much more fully, as his detailed studies, which are still in progress, proceed to the other islands. It is a distinct contribution to the geology of a region hitherto little understood, and is accomplished with a breadth of view which is commendable.

PHYSIOGRAPHY OF CHATTANOOGA DISTRICT.—The region of the southern Appalachians has been made historic ground to the American physiographer by the work of various members of the United States Geological Survey, particularly Hayes and Campbell. The latest contribution to the literature of this region by Hayes (Physiography of the Chattanooga District, *19th Annual Report United States Geological Survey*, Part II., pages 1–58), after describing the relation of this interesting district to the neighboring country, discusses the rock structure of the district, and follows this by a detailed study of the physiography. In the Chattanooga district Hayes finds evidence of three quite distinct peneplains at different levels. It would be unfair to criticise his discussion of the subject adversely without more familiarity with the district than is possessed by the reviewer, though from the statement of the case in Hayes's paper there seems to be a complexity of physiography which could be more easily explained on the basis of the simpler hypothesis of bevelling. Not only are there level-topped hills, suggesting three peneplain surfaces, but this diversity is still further marked by monadnocks and unakas—a new term, introduced in this paper for the first time, and indicating "a large residual mass in relief above a less advanced peneplain."

After a discussion of the evidence of peneplains, Hayes considers the stream development, explaining in a way which cannot be properly abstracted here the peculiar courses of the Tennessee, Coosa, and tributary streams. One of his conclusions of wide-reaching importance can be stated in the following quotation:

> Effects (upon stream courses) due to difference in rock character and in structure are generally more striking and are first detected, but the broad modifications of drainage are most apt to be produced by the slight warping of the land surface which appears to accompany all uplifts.

It seems questionable whether the application of this principle has been fully recognized in studies of American physiography.

Whether or not one is convinced of the various peneplains which Hayes has attempted to prove, this paper must, from all standpoints, be considered one of the most important contributions to American physiography.

NOTES ON GEOGRAPHICAL EDUCATION.

BY

RICHARD E. DODGE.

CO-OPERATION AMONG GEOGRAPHY TEACHERS.—The recent organization of several co-operative associations among geography teachers in this country and abroad is a healthful sign of the times in the geographical field. When teachers have so far advanced in their conceptions of their geographical needs as to seek aid and advice from their colleagues, it is safe to say that a good, though perhaps a small beginning has been made toward the improvement of geography teaching in elementary and secondary schools.

For several years the physiography teachers in the Chicago High Schools have met regularly to discuss their work and the methods of accomplishing the necessary results. Certain of the grammar school principals of New York City have recently combined in a similar way and have prepared and published a detailed series of suggestions * to teachers of geography in the elementary schools of New York City.

Such organizations are very helpful from an educational and social standpoint, and should be encouraged by all those leaders of teachers and superintendents who do not feel that a text-book needs no amplification or amendments. Organizations that will bring more distant teachers in touch, if rightly conducted, are still more helpful, as there is much less danger of inbreeding in the ideas suggested, and less likelihood of over-emphasis of some one phase of geography teaching—an important point in the elementary field.

For this reason such organizations as the Teachers' Geography Club, of Boston, Mass., and the American Bureau of Geography, of Winona, Minn., ought to be of great value to all who can co-operate in the work.

The Teachers' Geography Club was organized in 1897 by teachers in and about Boston who had received their inspiration from summer work with Professor Davis, of Harvard University. The object of the Club has been to promote a more thorough knowledge of geography, and to secure improvement in its teaching. The

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* Suggestions to teachers; in Geography 4^{A}–7^{B}. Privately printed.

Club now numbers about 160 members, of whom several are corresponding members, chosen largely from the well-known geography teachers of the United States.

During the winter months meetings are held for the discussion of geographical matters, and for the presentation of reports of the local committees. For effectiveness, the Club has a committee on pictures, one on books, one on magazines, one on local geography and excursions, and one on lectures.

That the Club considers all phases of geography work is very well evidenced by the following list of excursions that are being carried out during the present season: Excursion to BRIDGEWATER, MASS., morainal deposit, showing fine ice front, morainal beach, esker, natural form, transverse and longitudinal sections; MARBLEHEAD NECK, sea-cutting, cliffs, "The Churn"; GRAIN ELEVATOR, East Boston, a large steamer can be seen while freighting; LYNN WOODS, glacial evidences, "Boulder Path," ledges; ARNOLD ARBORETUM, complex esker and sand plain, an old river gorge and peat bed, adaptation of these features to man's use; ATHENÆUM PRESS, First Street, Cambridgeport, Mass., an opportunity to see how a geography is made from start to finish; KENNEDY'S CRACKER MANUFACTORY AND BRIGHAM'S MILK DEPOT, Cambridge; HARVARD UNIVERSITY, study of geographical equipment; QUEEN QUALITY SHOE FACTORY.

This year, for the first time, the Club is conducting a course of lectures for the benefit of the public and teachers. The subjects and the lectures are indicated in the following list, which will show the character of the work which the Club is trying to do: Prof. Charles E. Fay, The Canadian Alps; Prof. George H. Barton, Hawaii; Dr. William Z. Ripley, Geographical Factors in Human Affairs; Prof. Richard E. Dodge, Colorado Plateaux of New Mexico and their Ancient and Modern Civilizations; Miss Elizabeth F. Fisher, Russia and Its People; Mr. J. B. Woodworth, The Piedmont of Virginia; Dr. Frederick P. Gulliver, Holland; Prof. William M. Davis, The Geographical Effects of Glaciation; Mr. Edward Atkinson, The Physical Geography and Geology of the Cotton Plant; Prof. George L. Goodale, subject to be announced later.

The effectiveness of the Club's work has undoubtedly been largely determined by the fact that the Club has worked together in a small body in such a way as to give mutual and personal assistance. The plan of work that is done, and the scope of the Club's operations, offer valuable suggestions for interested teachers in other localities who desire to club together for mutual assistance.

The President of the Club is Miss Elizabeth F. Fisher, of Wellesley College, Wellesley, Mass.; the Corresponding Secretary is Mr. Philip Emerson, of the Cobbet School, Lynn, Mass.

The American Bureau of Geography is now being organized by Professor Edward M. Lehnerts, of the Normal School, Winona, Minn. The primary aims of the Bureau are: First, to make available to each member the valuable geographical material in the possession of his fellow-members; and second, to establish influences helpful to the teaching and the teacher of geography.

In accordance with this aim, the plan of work of the Bureau includes: Correspondence with educational men and women who are interested in geography and desire improvement in its teaching; organization of a system of exchange of products, geographic views, etc.

In addition to this the Director will publish quarterly a bulletin devoted to helps for the teaching of geography, with the co-operation of Mr. J. P. Goode, of the Normal School, Charleston, Ill.; Mr. C. F. King, of Dearborn School Boston, Mass.; Professor McCormick, of State Normal University, Normal, Ill.; Professor McFarlane, State Normal College, Ypsilanti, Mich.; Mr. J. W. Redway, Mt. Vernon, N. Y.; Mr. Roddy, Normal School, Millersville, Pa., and Professor Tarr, of Cornell University.

The scope of articles announced for the Bulletin is very inclusive, and if the plan is carried out the first number will be large and suggestive.

The plan of the whole Bureau is so very broad that there is danger of a scattering of activities, whereby the best cannot be done in any particular field. There is a chance for great good, if the plan is well conducted, particularly in the exchange of ideas and illustrative materials.

POPULAR LECTURES IN GEOGRAPHY IN NEW YORK CITY.—Last year mention was made in the *Bulletin** of the attention devoted to geography in the courses of Free Lectures to the People, given under the auspices of the Board of Education for the Boroughs of Manhattan and the Bronx, and under the direction of Dr. H. M. Leipziger, Supervisor of Lectures. Lectures are given regularly at some forty-four different lecture centres, usually to audiences of several hundred. Dr. Leipziger aims to have his lectures practical and helpful, and, so far as possible, arranged in a progressive series. As the audiences, largely composed of working men and women, who have little time for study and reading, remain very constant in their make-up during the season, the same people often occupying the same seats night after night, the educational results must be very great.

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* Bull. Am. Geog. Soc., XXX, 5, 1898, pp. 464–465.

Owing to the stirring events of the last two years there has been a deep interest in geographical topics, and the Supervisor has rightly devoted much attention to topics dealing with travel and descriptive geography. Some 545 lectures are to be given in the courses between October 1, 1899, and March 1, 1900. Of these 135 are announced under the heading of travel and descriptive geography, while many other lectures of a geographical nature are included under Natural Science, etc.

GEOGRAPHICAL PERIODICALS FOR TEACHERS.—The *Zeitschrift für Schul-Geographie*, now in its twenty-first volume, was probably the first special periodical devoted to the interests of geography teachers, but its influence has been very slight in this country. The *Journal of School Geography*, now in its fourth volume, was similarly the first special teacher's periodical in this country, though the host of papers of a local or national character that deal with the problems of elementary school work have long devoted a small portion of their space, mostly at irregular intervals, to the cause of geography teaching. A small paper, aimed to furnish teachers with the latest information in geography, has for two years been published by Superintendent Rupert, of Pottstown, Pa., under the title of GEOGRAPHICAL LEAFLETS. This paper, however, has not dwelt upon the problems of the teaching of geography, being primarily intended to furnish collateral geographical reading for school children.

Recently two new departures have been taken that should aid teachers greatly. The *National Geographic Magazine*, of Washington, D. C., which has hitherto had but an occasional teacher's article, is planning to publish a series of such articles in the near future, getting co-operation from the best-known teachers of geography available. Thus far two articles have appeared, both by Professor Davis, of Harvard University—one in November, 1899, entitled The Rational Element in Geography, and the other in February, 1900, entitled Practical Exercises in Geography, and devoted to the elaboration of practical problems available for elementary and secondary schools.

The latest addition to this branch of educational literature is the promised *Bulletin* of the American Bureau of Geography, already noted, the first number of which is announced for March. Special emphasis in this paper will not be given to any phase of geography teaching.

A NEW SCHOOL FOR COMMERCIAL GEOGRAPHY.—The increased attention given to commercial geography is not confined to this country. In the last number (January, 1900), of the *Annales de Géographie*, we find note of the recent founding at Lyons of a course planned to prepare young men for public life, to which M. Zimmermann has been called as professor of geography. This movement seems in line with several movements in this country that are now on foot for the opening of university courses planned to fit young men for business and public service.

GEOGRAPHY EXCURSIONS FOR SECONDARY SCHOOLS.—One of the most difficult and unsatisfactory phases of the teaching of geology and physical geography in secondary schools lies in the difficulty of conducting the necessary field excursions. Every one recognizes the need of field work, but, as yet, little has appeared in print that gives practical suggestions to those teachers who are not expert scientists. The Sub-Committee on Physical Geography, of the Committee on College Entrance Requirements of the National Educational Association, lay strong emphasis upon the need of field work, but offer few suggestions, while they give much more detail to the question of laboratory work (see Report of Committee, pp. 159–160).

Tarr* has given a number of suggestions of a general and yet helpful nature, which, however, are of little special assistance to the local teacher. Perry† has shown us clearly how to use the field of the vicinity of Worcester, Massachusetts, in the illustration of more distant and, perhaps, larger areas. The teachers of Chicago are supplied with a very valuable and complete syllabus pertaining to their city.

What is needed for the benefit of local teachers, as the Sub-Committee on Physical Geography has well emphasized,‡ is a series of guides for large cities, which could, perhaps, be used by a considerable number of schools located in a similar region.

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* Suggestions for Laboratory and Field Work in High School Geology, etc., The Macmillan Company, 1897; and Teachers' Outfit in Physical Geography, *School Review.* 1896, Vol. IV, pp. 161 and 193.

† Physical Geography in the High School, *Journal of School Geography*, Vol. III, pp. 130–138.

‡ loc. cit. p. 159.

Next to such local guides, with details of cost, routes, etc., are to be commended such scientific, simple, and readable accounts of a limited area as have lately appeared in reference to Worcester, Massachusetts, and Chicago, Illinois. The first by Mr. Joseph H. Perry* is a well-illustrated, interesting, accurate account of the region mentioned, that deserves wide mention and use. It should be of great value to all geography teachers of southern New England. The second and latest paper of a similar nature appears as Bulletin No. 1 of the Geographic Society of Chicago, and is entitled the Geography of Chicago and its Environs, by Rollin D. Salisbury and William C. Alden. This is a well-illustrated, very pleasing and helpful account of the physical features of Chicago and vicinity that ought to be of great service to teachers. The topography due to structure and to drift is first analyzed, and followed by a detailed account of the development of the topography in recent geological times. With such a guide and a good map the conduct of a field excursion ought to be an easy task, as far as equipment is concerned.

It is to be hoped that local workers in other centres may soon produce guides and local geographical histories that may be of similar service in teaching.

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* The Physical Geography of Worcester, Massachusetts, Worcester Natural History Society, 1898.

GEOGRAPHICAL RECORD.

AMERICA.

Agriculture in Alaska.—The Department of Agriculture and the War Department explorers have been collecting information with regard to the agricultural possibilities of Alaska.* The testimony of settlers also contributes to establish the fact that Alaska will have considerable development in that line. For 400 miles along the southeast coast, from Prince of Wales Island to Cape Fairweather, the influences favorable to vegetation include fairly abundant precipitation, a temperate climate, due to the Japan current, an unusual amount of summer sunshine and a deep, rich soil. These characteristics, in a lesser degree, are now found to extend 600 miles farther west, beyond Cook Inlet and penetrating inland, in places, at least 125 miles from the coast. Many hundreds of bushels of potatoes and all common vegetables are now raised at Tyoonok and other settlements along Cook Inlet. Lieut. Learnard, Fourteenth Infantry, tells of dinners at Cook Inlet at which everything on the table was raised in Alaska except the flour and butter. Excellent butter is made in the neighborhood of Sitka. Fine oats have been matured at Cook Inlet. The failure of the first attempt to raise wheat there was perhaps due to very late sowing in the fall. The station of the Department of Agriculture at Cook Inlet is continuing its experiments with wheat. Lieut. Castner, Fourth Infantry, says grass is abundant not only in the river bottoms of that region but also above the timber line, and that the bunch grass is especially nutritious. Capt. Glenn's expedition of 1898 reported that along the great valley of the Sushitna river the grass was of fine quality and would support a large amount of stock. The drawbacks to stock-raising are the long winters, which would necessitate curing a great deal of hay, and perhaps the mosquitoes and other troublesome insects. Capt. Abercrombie says the development of agriculture in the Copper River region, farther east, will be conditional only upon finding a market for the produce. Mr. Sittell reports from Copper Centre, 125 miles inland, that practically all vegetables may be raised there. Mr. William Ogilvie, at Dawson, has estimated the agricultural area of the upper Yukon at about 460,000 acres, but it is probable that the produce of this region will be confined to a few hardier vegetables. It is likely that what is achieved on the extreme northern farming lands of Europe may be done in Alaska. Drainage, transportation and markets will offer serious problems, but Alaska may in time produce all the food required by its inhabitants.

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* See "Agricultural Experiments in Alaska," by C. C. Georgeson, M. S.; "Year Book of the Department of Agriculture, 1898;" also "Reports of Explorations in the Territory of Alaska;" War Department, No. XXV., 1899.

CANADA'S CANALS.—The new locks in the St. Lawrence canals, completed in November last, admit vessels of 270 feet, and the entire system has been deepened to fourteen feet. The steamer *Porto Rico*, 250 feet long, has arrived at New York from the Great Lakes and the St. Lawrence river. Between the Lake Erie entrance to the Welland canal and Montreal there are 84 miles of canals. The remainder is lake and river navigation, where steamers may move at their best speed, and from Montreal there is deep water to the sea. The canals formerly had a depth of only nine feet and their original cost and the later improvements have involved an expenditure of over $60,000,000. The new facilities will augment the commercial importance of Montreal; but if the St. Lawrence canal system is to be made available for the larger lake shipping a vast expenditure will still be required to give the canals adequate depth.

THE FATE OF THE IBARRETA EXPEDITION.—The Argentine newspapers print all the details known of the tragic fate of the expedition led by Enrique Ibarreta, the civil engineer, who set out on May 8, 1898, to descend the Pilcomayo River from its source in the highlands of Bolivia through the plain of the Gran Chaco to the Paraguay. On December 21 two of the party reached Asuncion, seeking relief for the expedition which had surveyed the river for 400 miles and had reached the swamps of Patino, 200 miles above the Paraguay. Their supply of provisions gave out and game was not sufficiently abundant to support the party. The leader sent eight men down the river to procure relief and he and two comrades remained with the boats. The eight men had no food for days, and six of them perished, only two reaching the Paraguay at last in terrible plight. Dr. José Montero was sent up to Pilcomayo with food supplies, and found indubitable evidence that Ibarreta and his two companions had been massacred and their small boats destroyed by Indians. Thus nine of the eleven members of the party perished.

ASIA.

A STEAM ROUTE ACROSS ASIA.—The Siberian railroad was completed on December 28 to Stretensk, 693 miles east of the eastern shore of Lake Baikal. Work on the main line will stop at this point for an indefinite period. Stretensk is on the Shilka river, a tributary of the Amur, and steamboats run in summer from the end of the railroad down the Shilka and Amur to the north end of the railroad which follows the Ussuri river to Vladivostok. Thus by rail and steamer the transcontinental line of communication is now complete from the Atlantic to the Pacific. Not far from Stretensk the line between the Siberian Railroad and Port Arthur is now constructing by the Eastern Chinese Railroad Company, and a branch will connect this line with Vladivostok. It is thus that Vladivostok will first be joined by rail with Moscow, and it is not known when the work of extending the main line beyond Stretensk, which involves very costly engineering, will be resumed. There is a short break in the main line at the south end of Lake Baikal, where the mountains press closely upon the shore, and at present large ferryboats carry trains across the lake to the rails on the east shore.

DEASY'S EXPLORATIONS IN EAST TURKISTAN.—Capt. Deasy, the English explorer, returned to London in December after two years of exploration in almost unknown parts of East Turkistan and Western Tibet, during which he travelled about 5,300 miles. After reaching the headwaters of the Yarkand river he attempted to descend this long and rapid mountain stream, flowing out into the desert, in order to map its unknown parts. Although public orders had been sent to the Chinese officials to give him every assistance, he found that private instructions had been simultaneously issued to impede his progress in all ways, and his first attempt was a failure, though he subsequently completed the exploration of the river by ascending it. Before renewing his work on the Yarkand, however, he went to Polu, near the northern frontier of central Tibet, and made a triangulation across the Kuen Lun range, collecting data needed to determine the height and position of about ninety mountains. He also discovered the source of the Khotan river. Then he carried out his final and successful explorations on the Yarkand, and later undertook further explorations in northwest Tibet, but on account of the hostility of the inhabitants he was compelled to return to India without accomplishing all he had planned to do.

THE NEW HIGHWAY IN PERSIA.—The highway from Resht, on the Caspian Sea, to Teheran, begun by the Russian Government three years ago, is now completed. Practically all the growing commerce between Russia and Persia passes over the Caspian, and it is expected that the new road will facilitate these trade relations. The *Geographische Zeitschrift* says the road is 217 miles long and great technical difficulties had to be overcome. The Persian Government controls the road and has erected nine stations along the route, where tolls are levied. The Russian officials are permitted merely to see that the road and the telegraph line are kept in repair. It is said the Russians will continue the road to Ispahan.

AFRICA.

COMPLETION OF THE SUDAN RAILROAD.—The first through train between Wady Halfa and Khartum reached the latter city on January 10, and thus steam communication between Cairo and the capital of the Egyptian Sudan is completed. It is not entirely a rail route, for a break in the railroad occurs between the First Cataract at Assuan and the Second Cataract at Wady Halfa, steamboats covering the distance between these towns. From Wady Halfa the rail route strikes straight across the desert southeast to Abu Hamed, on the Nile, and then follows the river to Khartum. The distance by rail and river is about 1,325 miles, of which the railroad from Cairo to Assuan covers 550 miles, the Nile steamers from Assuan to Wady Halfa 200 miles, and the railroad from Wady Halfa to Khartum 575 miles. Khartum may now be reached in three and a half days from Cairo, according to the published time-table, which names thirty-two hours as the time between Wady Halfa and Khartum. The doors of the Egyptian Sudan, which were closed against all the world for over fifteen years, are now opened wide by the completion of this railroad.

FRANCE'S ADVANCE IN THE SAHARA.—In November last the railroad starting from Aïn Sefra, the mountain town in south-west Algeria, was completed about twenty-five miles to the Moghar oasis, on the edge of the desert. This is the first section of the railroad that is to be extended by way of the oasis of Igli to the group of oases at Tuat. The distance from Oran, on the Mediterranean, to Tuat by rail will be about 780 miles. Meanwhile a French force has occupied the important Arab town of Insalah, 100 miles east of Tuat. In this part of the northern Sahara there are three large centres of oases, which France proposes to include in the Government of Oran. The oases of Gurara are the most northern of these groups; about 150 miles south of them is the Tidikelt group, of which

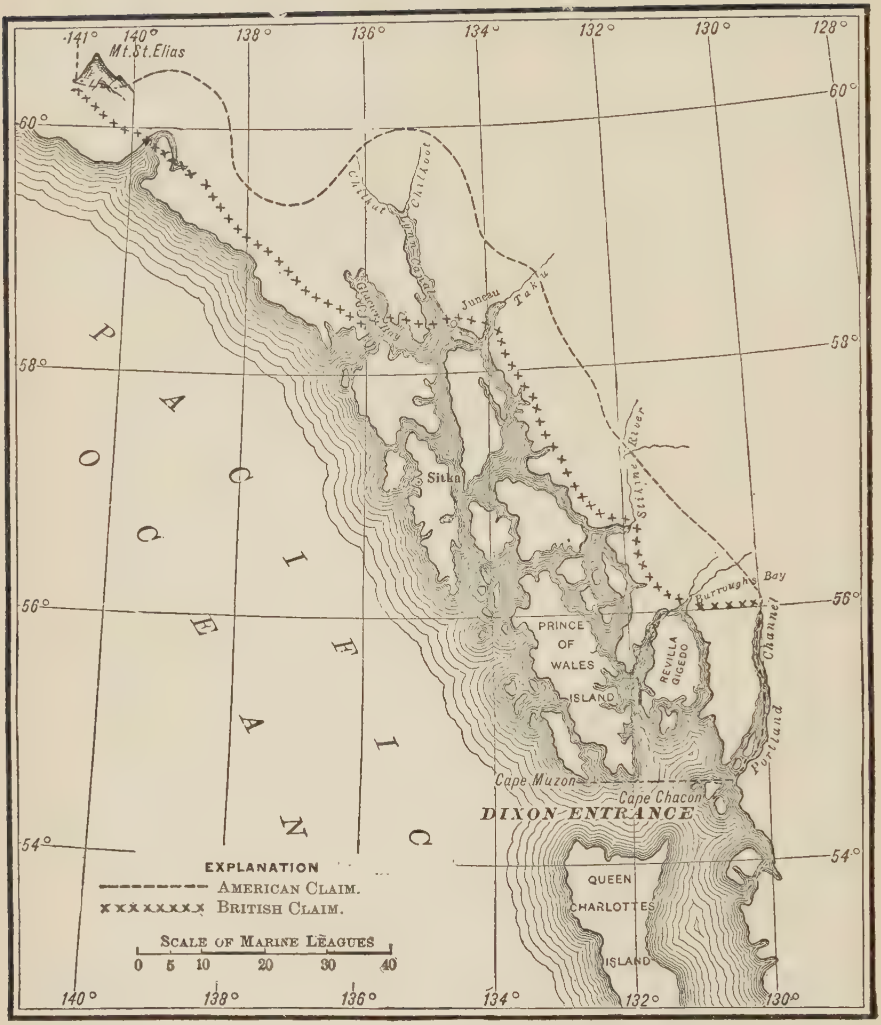
Insalah is the chief town. A little farther to the west is Tuat, the third centre of fertility. France has first established her supremacy in the central group. The three regions are believed to have about 150,000 inhabitants. These oases are of great fertility, but the political value of their subordination to the French régime will outweigh economic considerations. They have been a hotbed of conspiracy against France and the main source of the food supply of the Ahaggar Tuaregs, the most formidable foes of the Europeans in the desert.

THE SUDD IN THE NILE.—The water receipt of the Lower Nile from the great equatorial lakes is at present practically cut off. It takes nearly a year for the water from the central African lakes to reach lower Egypt, and the effect of this failure of supply from the upper river will not be felt by the farmers of Egypt till next spring and summer. The fertilizing quality of the Nile waters is derived from the Blue Nile and the Atbara, coming from the Abyssinian mountains, but a large admixture of White Nile waters is important to give the needed supply for irrigation. Mr. Willcocks, a hydrographic engineer in the service of Egypt, says the reason for the failure of the White Nile supply is that the river and its main tributaries south of 9° N. lat. are blocked by sudd for about 150 miles, and the accumulating flood has poured over the low banks into a vast swampy area, where it has rapidly evaporated. He estimates that it will cost $3,000,000 to do away with the sudd nuisance. His proposal is to dam up the entrance to the side channels, raise the banks of the main channel, and by keeping the waters from the great lakes in one channel he believes they will dispose of any amount of sudd.

COMMERCIAL GEOGRAPHY.

THE LARGEST PRODUCER OF COAL.—In 1899 the United States took its place at the head of the coal-producing countries. For thirty years Great Britain, the United States, Germany and France, the largest producers, have steadily increased their output; but no country has equalled the percentage of increase recorded in the United States, which trebled its production between 1870 and 1895, and has finally surpassed Great Britain by an enormous increase in productivity never equalled before in a single year. The United States output in 1899 was over 244,000,000 tons, which was 49,000,000 more than were mined in the preceding year. This increase in production in one year was greater than the entire average output of any country in the world excepting Great Britain during the five years 1871–5.

INTERIOR SEA PORTS.—Despatches from Berlin say that the building of the Berlin-Stettin ship canal is now assured, and a commodious harbor is to be built at Berlin. The project of making Brussels a maritime port, by means of a canal from the Scheldt, is already under way. A basin of thirty acres is to be constructed, with a depth of eighteen feet, and commodious wharves will be built. Ghent, the leading industrial city of Belgium, also on the Scheldt, is preparing to accommodate vessels 460 feet in length. A port is also under construction at Bruges, and the short canal connecting the city with the sea at Heyst is to be greatly enlarged.



SKETCH-MAP OF SOUTH-EAST ALASKA.

THE ALASKA BOUNDARY LINE,

AN ADDRESS BEFORE THE AMERICAN GEOGRAPHICAL SOCIETY,

BY

T. C. MENDENHALL,

President of the Worcester Polytechnic Institute.

A few years ago I had the pleasure of addressing the Society upon the Boundary Line separating Southeast Alaska from the British Northwest Territory, calling attention to the ambiguous and uncertain definition of the line in the treaty between Russia and Great Britain, in which it was originally defined, and predicting a controversy, the beginnings of which were even then in evidence. Since then, as everybody knows, this controversy has grown in magnitude and intensity until it has attracted the attention of most intelligent people, and it is everywhere acknowledged to be of such importance as to justify a review of the situation at the present time. As a nation we have often been singularly negligent in the making of treaties involving delimitation of territory, and especially so in our intercourse with Great Britain, with which nation our territorial relations have been most intimate. Up to this time we have shown little, because we have felt little, of that spirit of "hold-fast," which has always characterized the diplomatic policy of the English people. We have been so busy in the occupation and development of the great interior that a few hundred square miles here and there of distant, unsettled regions have seemed to us of little importance. A better understanding on the part of the masses of our people of the interests involved would do much to secure a more vigorous support of just claims on the part of our government authorities; and it is hoped that a dissemination of better information as to the nature of the present dispute will result in a popular demand for a rigid insistence upon those claims. But it must not be assumed that the question of the Alaska Boundary is entirely one-sided. There are serious difficulties in the interpretation of the language of the treaty, and to some of these it will be well to give careful consideration.

It is well known that in the purchase of this territory in 1867 it was conveyed to us in the language of the treaty between Russia and Great Britain, made in 1825. Whatever jurisdiction and rights we may possibly claim now were those claimed and exercised by Russia from 1825 to 1867—no more and no less.

That part of the treaty which is responsible for the pending controversy is as follows:

> "Commencing from the southernmost point of the Island called Prince of Wales Island, which point lies in the parallel of 54° 40′ north latitude and between the 131st and 133d degrees of west longitude (meridian of Greenwich), the said line shall ascend to the north along the channel called Portland Channel as far as the point of the continent where it strikes the 56th degree of north latitude; from this last-mentioned point the line of demarcation shall follow the summit of the mountains situated parallel to the coast as far as the point of intersection of the 141st degree of west longitude (of the same meridian) and finally from the said point of intersection, the said meridian line of the 141st degree, in its prolongation as far as the frozen ocean."

The first apparent difficulty is the determination of what is meant by "the channel called Portland Channel." The Canadians, many of them, have interpreted this to mean that on leaving the southernmost point of Prince of Wales Island the line should be drawn at once to the north as far as the 56th parallel of north latitude, and this carries it to the west of the great Revilla Gigedo Island into Burrough's Bay,* thus throwing that island and a large block of the mainland under their jurisdiction, although now claimed by us. In order to enter what has always been known as Portland Channel it is necessary to proceed from the beginning at Prince of Wales Island straight to the east for about sixty miles, and then "ascend to the north along the channel," which is the line we claim. The omission of a reference to this easterly line in the treaty opens the door for the British contention, and to support it they maintain that the use of the name Portland Channel was an oversight. We contend, on the contrary, that the omission of the fifty or sixty miles of easting from the southernmost point of the Prince of Wales Island is of no special importance, because it would be assumed that before you can ascend along a channel you must get into it.

This point was strongly insisted upon for several years by Canadian authorities, but it has been practically given up as unreasonable and untenable, in the conferences of the Joint Commissioners appointed a year or two ago. A far more serious claim is based on the next phrase of the treaty, which declares that after leaving Portland Channel

> "the line of demarcation shall follow the summit of the mountains situated parallel to the coast as far as the point of intersection of the 141st degree of west longitude," etc.

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* Or Inlet.

The charts of this region on which the treaty-makers principally relied were those of Vancouver, who explored the northwest coast in the interests of the British Government about one hundred years ago. Vancouver traversed the estuaries and followed the windings of the coast pretty thoroughly, but he did not go inland, all of his work being done, in fact, from the deck of his ship. On his charts a beautifully continuous range of mountains is shown, skirting the coast about 35 miles back from the shore. This range was proposed by the Russian diplomats as a suitable natural boundary. The English, however, were suspicious of the accuracy of Vancouver's map, and were especially concerned lest the range of mountains shown thereon should be found to be really further from the coast than 10 marine leagues. They cited the fact that they had only a few years before encountered difficulty in settling a boundary controversy with the United States, on account of the discovery that mountain ranges shown upon the map did not so exist actually upon the ground. They proposed that the line should be fixed at ten marine leagues, about 35 miles, from the windings of the coast, and it was finally agreed to insert the modifying clause,

> "that whenever the summit of the mountains which extend in a direction parallel to the coast from the 56th degree of north latitude to the point of intersection of the 141st degree of west longitude shall prove to be at a distance of more than ten marine leagues from the ocean, the limit between the British possessions and the line of coast which is to belong to Russia, as above mentioned, shall be formed by a line parallel to the winding of the coast, and which shall never exceed the distance of ten marine leagues therefrom."

It is a fact of the utmost importance that the English representatives were willing to accept a line "always at a distance of ten marine leagues from the shore," and that they protected themselves against a possible divergence of the supposed range of mountains to a greater distance inland. The extension of the line to the north along the 141st degree of longitude west of Greenwich is a simple astronomical problem over which there can be no dispute, and so the whole controversy is over the meaning of that part of the treaty which defines the boundary from the point where the Portland Channel meets the 56th parallel of north latitude to the 141st meridian, which it intersects very nearly at the summit of Mount St. Elias. The superiority of English diplomacy is shown in the wording of the treaty so that, while the swinging of the mountain range inland beyond the ten marine leagues shall not carry the boundary line with it, if it should be found to be really less than that distance from the shore, the Russian holdings must be reduced accordingly.

About ten years ago the United States began a survey for the purpose of definitely locating this boundary line. The first work was the establishment of astronomical stations on tributaries of the Yukon, to determine and mark at a few important points the 141st meridian north of Mount St. Elias. About 1891 a survey of the lower part of the region traversed by the boundary was undertaken by the United States and Canada jointly, but it was agreed that the two parties should work independently of each other, so that more ground might be covered, each Government to receive the results of the work of the other. A large part of the work was topographical, especially that of the Canadian parties.

The result of this survey was to prove, at least to the satisfaction of those representing the American side of the controversy, that the range of mountains shown on Vancouver's map does not exist, and that within the prescribed distance of ten marine leagues there is *no* range of mountains in Southeast Alaska "parallel to the windings of the coast." Mountains there are in plenty, but they are scattered about in absolute irregularity, generally increasing in height towards the east, but nowhere simulating a range, except in the northern extremity of the territory under consideration, where is to be found the Fairweather range, and possibly for a short distance in the neighborhood of the White and Chilkoot passes.

The American contention is, therefore, that in view of the failure of the first paragraph in its application to existing conditions, it becomes necessary to fall back upon the second and fix the boundary line at ten marine leagues from the shore, parallel to the windings of the coast.

To this argument Canadians have replied that the phrase "shall follow the summit of the mountains parallel to the coast" is applicable to those mountains which are admitted to be generally but irregularly distributed over the strip of territory in dispute, and that the line should be laid down by joining the summits of those nearest the shore. The effect of the adoption of this principle is to place the line everywhere very near the coast, leaving almost nothing but the western mountain slopes to the United States, and, what is more important, interrupting at several points the continuity of our coast line, giving to Great Britain many important estuaries, waterways and harbors. Indeed, it is clear in all of the negotiations that the primary object of Great Britain is to obtain coast line by which she may control admission to the interior.

Recognizing the difficulty of interpreting this treaty, Americans have very properly called to their support the doctrine of *vested rights*, accruing from continuous and undisputed and *unmixed* occupancy. Here it cannot be denied that everything is in our favor. From 1825 to 1867 the Russians claimed this territory, as we now claim it, without a word of protest from Great Britain. Not only Russian maps, but *all* maps drawn, up to a very recent time, showed the boundary where we believe it should be. All English charts so represent it. The Hudson Bay Company, an English corporation, leased from Russia a large part of this strip of land, following and adopting the boundary line as now claimed by us, paying an annual rental for its use. Before Parliamentary Committees the territory thus leased was defined and acknowledged by these maps, and in numerous proceedings the Russian claim was admitted without question. Many important points were actually occupied by Russian colonies, and none by British.

After the United States assumed jurisdiction in 1867, the Department of State published a map showing the bounds of the newly acquired territory; many American enterprises were established within the now disputed area, some at the extremest points, all without a word from Great Britain; and there was never an attempt to colonize this region by British subjects. Only a little more than ten years ago, when the value of the mineral resources of the region began to be understood, the first Canadian map was printed showing any other line than that now claimed by us. Even now English maps, almost without exception, show the boundary line as it is found on our own maps, and as late as about a year ago the *Scottish Geographical Magazine*, an acknowledged authority on cartography, published a very complete map of the whole region, with the boundary laid down in agreement with American claims. As to the absolute justice of these claims there can be no doubt in the minds of competent but unbiassed authorities. During the session of the Joint Commission the British Commissioners submitted a proposal to arbitrate the whole question in conformity to the terms of the Venezuelan arbitration, but they declined to consent to the selection of an umpire from the American continent. The American Commissioners proposed to submit the matter to a tribunal consisting of three judges of the highest standing in each country, a binding decision to be reached by at least four of these. This proposition, which must impress all as being eminently fair, was rejected by the British Commissioners, and no further attempt to reach an agreement was made by the Joint Commission.

Through the ordinary diplomatic channels a tentative agreement has been reached, covering a small portion of the line in the neighborhood of the passes at the head of Lynn Canal, where most conflict of jurisdiction has occurred, and a temporary relief from strained relations is promised. It will be but temporary, however, and it would have been safer and better if the United States had stood squarely for its contention in every detail. If once submitted to arbitration the result would be a compromise, regardless of our real rights, and these are so clear that no concession ought to be made.

MAP NOTICES.

BY

HENRY GANNETT.

Atlas of the State of Pennsylvania, prepared under the direction of Joseph R. Bien, Julius Bien & Company, New York, 1900. Folio II., Plates XLVII., with Index.

As is stated in the title, this atlas has been compiled from the original surveys and various local surveys revised and corrected, the whole structure resting upon the triangulations and surveys of the U. S. Geological Survey, U. S. Coast and Geodetic Survey, U. S. Lake Survey, and the Second Geological Survey of Pennsylvania.

The atlas comprises a large folded map of the United States showing counties, reduced from the nine-sheet map of the U. S. Geological Survey, a large folded map of Pennsylvania, scale 1 inch to 8 miles, a geological map of the State, a relief map, and a map showing mean annual rainfall and temperature. This is followed by statistical diagrams. The body of the atlas is composed of county maps, on a scale of 1 inch to 3 miles, and maps of the largest cities and their environs.

The county maps represent the township, city and borough boundaries, streams and roads, but make no attempt at representing the relief, which, in fact, is too imperfectly known over most of the State to warrant any attempt at its representation.

This is, doubtless, as accurate and complete a representation of the State of Pennsylvania as can be made with our present knowledge of it, and will remain the primary source of geographic information until the completion of the survey of the State by the U. S. Geological Survey.

The engravings, printing, paper and binding are of the best.

The Report of the Nicaragua Canal Commission has just been issued in the form of a quarto volume of 500 pages, and a portfolio containing 7 maps and 6 profiles.

Map No. I is issued in the form of 4 sheets, sheet No. I being a general map of the Nicaragua Canal region, sheet No. II the geology of the same region, being the same as Map No. I, upon which geological colors are superimposed; sheets Nos. III and IV represent the rainfall for 1890 and 1898 respectively over the same region.

Map No. II, issued in 3 sheets, shows the projected lines of the canal, upon a scale of 5,000 feet to 1 inch.

Map No. III is issued in 20 sheets, together with an index, and shows the projected lines of the canal on a scale of 1,500 feet to 1 inch, in great detail.

Map No. IV is Greytown Harbor.

Map No. V is the Harbor of Brito.

Map No. VI shows the hydrography of the Caribbean coast from Indio River to the mouth of the Colorado, and

Map No. VII shows Lake Nicaragua with soundings.

The profiles are those of the various proposed routes for the canal and for a railroad across the isthmus.

The work is an important contribution, not only to the immediate purposes of building the canal, but to general geographic information concerning the region.

ACCESSIONS TO THE LIBRARY.

JANUARY–FEBRUARY, 1900.

BY PURCHASE.

Combination Atlas Map of Genesee County, Philadelphia, 1876, 4to; Promenades et Escalades dans les Pyrénées, par Jules Leclercq, Tours, 1877, 8vo; Les Sanctuaires des Pyrénées, traduit de l'Anglais de Lawlor, Tours, 1875, 8vo; Chronicle and Directory for China, Corea, etc., Hongkong, 1893, 8vo; Hongkong Directory and Hong List for the Far East, Hongkong, 1885, 8vo; Selections from Calcutta Gazettes, 1784–1788, by W. S. Seton-Karr, Calcutta, 1864, 8vo; Ancient Cures, Charms and Usages of Ireland, by Lady Wilde, London, 1890, 8vo; Pflanzengeographie auf physiologischer Grundlage, von Dr. A. F. W. Schimper, Jena, 1898, 8vo; Dictionary of National Biography, edited by Sidney Lee, Vol. LXI, London, 1900, 8vo; Europe, the Countries of the Mainland, etc., by Geo. G. Chisholm (Stanford's Compendium, Europe, Vol. I), London, 1899, 8vo; Whittaker's Almanac, 1900, London, 1900, 8vo; Who's Who? 1900, London, 1900, 8vo; The Oxyrhyncus Papyri, Part II (Egypt Exploration Fund, Græco-Roman Branch), London, 1899, 4to; Life in the Wilderness, or Wanderings in South Africa, by Henry H. Methuen, London, 1848, 12mo; The Destruction of Ancient Rome, by Rodolfo Lanciani, New York, 1899, 8vo; The Yangtze Valley and Beyond, by Mrs. J. F. Bishop, New York, 1900, 2 vols., 8vo; Les Anciens Normands chez eux et en France, par Gabriel Gravier, Rouen, 1898, 4to; Historical Index to the Manuals of the Corporation of the City of New York, 1841–1870, New York, 1900, 8vo; Sketches of Brazil, by Robert Dundas, London, 1852, 8vo; Incidents of a Journey through Nubia to Darfoor, by F. Sidney Ensor, London, 1881, 8vo; The Natural History and Antiquities of Selborne, by Gilbert White, New York, 1875, 8vo; In Scripture Lands, by Edward L. Wilson, New York, 1890, 8vo; The Real Malay, by F. A. Swettenham, London and New York, 1900, 8vo; The Great Company (Hudson's Bay), by Beckles Willson, New York, 1900, 8vo; The Life of James Dwight Dana, by Daniel C. Gilman, New York and London, 1899, 8vo; Side Lights on South Africa, by Roy Devereux, New York, 1899, 8vo; Some South African Recollections, by Mrs. Lionel Phillips, London, 1899, 8vo; The Caroline Islands, by F. W. Christian, New York, 1899, 8vo; King Stork and King Log, by Stepniak, London, 1895, 2 vols., 8vo; Historical Guides, Paris, by Grant Allen, London, 1897, 8vo; Historical Guides: Florence, by Grant Allen, London, 1897, 8vo; The Colonies: The Ionian Islands in Particular, by Charles James Napier, London, 1833, 8vo; The Pioneers of the Alps, by C. D. Cunningham and W. de W. Abney, 2nd edition, London, 1888, 4to; The Industries of Russia, edited by John M. Crawford, St. Petersburg, 1893, 5 vols., 8vo; The Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaites, Vols. LIX–LXII, Cleveland, 1900, 8vo; Le Transvaal et l'Angleterre en Afrique du Sud, par Georges Aubert, Paris, (1900), 18mo; Sketches of St. Augustine, by R. K. Sewall, New York, 1848, 8vo; In the Land of Misfortune (South Africa), by Lady Florence Dixie, London, 1882, 8vo; Journal of Voyages and Travels by Daniel Tyerman and George Bennet, etc., in the South Sea Islands, China, etc., Boston, 1832, 3 vols., 12mo; Journal d'un Voyage en Orient, par Joseph D'Estourmel, à Paris, 1844, 2 vols., 8vo; Korea and the Sacred White Mountain, by A. E. J. Cavendish, London, 1894, 4to; The Seminoles of Florida, by Minnie Moore-Willson, Philadelphia, 1896, 16mo; Life of Jedidiah Morse, by William B. Sprague, New York (1874), 12mo; Atlas of the State of Pennsylvania, prepared under the direction of Joseph R. Bien, New York, 1900, folio; The Puritan in Holland, England and America, by Douglas Campbell, New York, 1893, 2 vols., 8vo; Economic and Social History of New England, by W. B. Weeden, Boston, 1891, 2 vols., 8vo; History and Antiquities of Boston, by Samuel G. Drake, Boston, 1856, 8vo; The Russian Storm-Cloud, by Stepniak, London, 1886, 8vo; Introduction to a Historical Geography of the British Colonies, by C. P. Lucas, Oxford, 1887, 8vo; Historical Geography of the British Colonies, by C. P. Lucas, Vols. 1 and 2, Oxford, 1888, 1890, 8vo; The New Laws of the Indies (with Spanish Text), by Henry Stevens and Fred. W. Lucas, London, 1893, folio; Handbook of the Elements of Place Names in the North-West Provinces of India, by Paul Whalley, Calcutta, 1899, 8vo; Instruccion Reservada que el Conde de Revilla Gigedo, dio a su succesor en el mando, etc., Mexico, 1831, 8vo; A Voyage to East India, etc., by Edward Terry, reprinted from the Edition of 1655, London, 1777, 8vo; The Druzes and the Maronites, 1840–1860, by (C. H.) Churchill, London, 1862, 8vo; A Residence in Jutland, the Danish Isles and Copenhagen, by Horace Marryat, London, 1860, 2 vols., 8vo; Constantinople, by Edmondo de Amicis, translated by M. H. Lansdale, Philadelphia, 1896, 2 vols., 8vo; Last Winter in the United States, by F. Barham Zincke, London, 1868, 8vo; The Baths and Wells of Europe, by John Macpherson, London, 1869, 8vo; Our Baths and Wells, by John Macpherson, London, 1871, 8vo; A Dictionary of Place-Names, by C. Blackie, London, 1887, 8vo; Romantic Spain, by John Augustus O'Shea, London, 1887, 2 vols., 8vo; History of Yonkers, by Charles E. Allison, New York (1896), 4to; From Pharaoh to Fellah, by C. F. Moberly Bell, London (1887), 4to; A Residence among the Chinese, by Robert Fortune, London, 1857, 8vo; Indian Myths, by Ellen Russell Emerson, London (1884), 8vo; Les Ecossais en France et les Français en Ecosse, par Francisque-Michel, Londres, 1862, 2 vols., 8vo; On the Broads, by Anna Bowman Dodd, London, 1896, 8vo: The Danube, by F. D. Millet, New York, 1893, 8vo; Old Deccan Days, by M. Frere (reprint), Albany, N. Y., 1897, 8vo; Scribner's Popular History of the United States, Vol. V. (supplementary volume of Bryant and Gay's History), New York, 1899, 8vo; The American in Holland, by William Elliot Griffis, Boston, 1900, 8vo; The European Tour, by Grant Allen, New York, 1899, 8vo; About the Weather, by Mark W. Harrington, New York, 1899, 8vo; Volcanoes, their Structure and Significance, by T. G. Bonney, New York, 1899, 8vo; The Florida of To-day, by James Wood Davidson, New York, 1899, 16mo; The Pilgrim Fathers, Exhibition of Documents at Leiden, etc., Leiden, 1888, 16mo; The Old Stadt Huys of New Amsterdam, by J. W. Gerard, New York, 1875, 8vo; Historia Geográfica, Civil y Politica de la Isla de S. Juan Bautista de Puerto Rico (Iñigo Abbad), Madrid, 1788, 4to; The Forgotten Isles: Balearic Isles, etc., Gaston Vuillier, New York, 1896, 8vo; Soldiering and Surveying in British East Africa, by J. R. L. Macdonald, London, 1897, 8vo; America in the East, by William Elliot Griffis, London, 1899, 8vo; An Eclipse Party in Africa, by Eben J. Loomis, Boston, 1896, 8vo; Elements of Geology, by Joseph Le Conte, 4th edition, New York, 1899, 8vo; A Political History of Europe since 1814, by Charles Seignobos, translation edited by S. M. Macvane, New York, 1900, 8vo; Russia in Asia, 1558–1899, by Alexis Krausse, New York, 1899, 8vo; Geologische Studien in der Republik Colombia, II, Petrographie, 2., W. Reiss und A. Stübel, Reisen in Süd-Amerika, Berlin, 1899, 4to; History of the Great Boer Trek, by Henry Cloete, London, 1900, 8vo; Antiquities of Long

Island, by Gabriel Furman, edited by Frank Moore, New York, 1874, 12mo. Publications of Societies, New York, 1899, 8vo; Report of the Nicaragua Canal Commission, 1897–1899, Baltimore, 1899, 1 vol., 4to and portfolio.

GIFTS.

From Anthony J. Drexel-Biddle, Author:

The Madeira Islands. London, 1900, 2 vols,, 8vo.

From Émile Cammaerts, Translator:

Formation des Dunes de Sable, par Vaughan Cornish. (Article paru dans le numéro de Mars, 1897, du "Geographical Journal.") Traduit de l'Anglais par E. Cammaerts. Bruxelles, 1900, 8vo.

From Miss Cornelia Horsford, Author:

Vinland and its Ruins: Some of the Evidences that Northmen were in Massachusetts in Pre-Columbian Days. 1899, 8vo. (Reprint.)

From the Trustees of the Public Library, Museums and National Gallery of Victoria, Melbourne:

Letters from Victorian Pioneers: A series of Papers on the early occupation of the Colony, the Aborigines, etc., edited by Thomas Francis Bride, LL.D. Melbourne, 1899, 8vo.

From George H. Pepper, Author:

Hyde Expedition, Ceremonial Deposits found in an ancient Pueblo Estufa in Northern New Mexico, U. S. A. New York, 1899, 8vo. (Reprint.)

From Professor G. Schlegel, Author:

Geographical Notes, No. XIII. Reprinted from T'oung Pao, Vol. X, No. 5. Leyden, 1899, 8vo.

From the Société d'Ethnographie, Paris:

Archives de la Société Américaine de France, Nouvelle Série, Tome 1er. Paris, 1875, 8vo.

From the Université Laval, Québec:

Noëls Anciens de la Nouvelle-France: Etude Historique, Ernest Myrand. Québec, 1899, 8vo.

BOOK NOTICES.

The International Geography. Hugh Robert Mill, Editor. D. Appleton & Company, New York. 8vo, 1089 pp., 487 figures in the text.

This important handbook of geography is prepared by seventy authors under the general editorship of Dr. H. R. Mill, Librarian of the Geographical Society of London. The ten chapters of Part I deal with the principles of the science. Among the authors are Dr. J. S. Keltie, Dr. John Murray, Dr. J. W. Gregory, and the Editor. The subjects treated are: Mathematical Geography; Maps; The Plan of the Earth; Land-Forms; The Oceans; The Atmosphere and Climate; The Distribution of Living Creatures; The Distribution of Mankind; Political and Applied Geography.

The bulk of the volume is devoted to regional geography, and is prepared by experts in their respective fields. Thus, the United Kingdom is treated by Dr. Mill, the physical geography of France by Professor A. de Lapparent, and Austria by Professor Penck. Continental summaries precede the accounts of the several countries. Thus, North America is described as a whole by Professor W. M. Davis; while Canada is taken by Mr. J. B. Tyrrell, the United States by Professor Davis, Mexico by Professor A. Heilprin, and Cuba and Pórto Rico by Mr. R. T. Hill. The continent of South America is described by Dr. A. J. Herbertson, of Oxford; Ecuador, Peru and Bolivia by Sir Clements R. Markham, and the Arctic regions by Nansen. Thus we have sufficient indication of the character of the work. Compact statistics and a bibliography close each chapter, and a copious index closes the volume. The illustrations consist largely of sketch maps of physical and political features.

With this brief notice of the general plan, our review must limit itself to some of the chapters upon North America. Professor Davis' account of the continent is short, but discriminating. The homologies of North and South America and of our continent and Eurasia are recognized and rationally stated, but we are put upon guard against resemblances that are fanciful. The contrasts are not neglected. The physical features—such as the shore-lines, the Laurentian and Appalachian Highlands, the Rocky Mountains, etc.—are genetically described, and climate is illustrated by temperature and rainfall maps, followed by notices of the aboriginal people, of the history of settlement and of territorial growth.

In the account of the United States the same author gives us the longest chapter in the book, and the Editor characterizes it as perhaps the most instructive, by virtue of its novel and scientific plan. Reference is here had to the methods of the new geography, which are freely used. The country is subdivided into physical districts rather than into States, which latter often have no physical unity. Thus the Appalachians are parcelled out among many States, and a State like New York is composed of mountain, plateau and plain. The diversity of State legislation is illustrated in the brief notice of our political system, and there is a judicious reference to the effect of excessive immigration upon our municipal life. Equally just reference is made to the value of our scientific bureaux, and to the character and generous distribution of their reports.

The chapter deals mainly, however, with regional geography. Among the noteworthy illustrations of the genetic method we find here the origin of Appalachian topography as now understood. The stages of this history have now become familiar to many students of geography. They are, in brief, very ancient making of high mountains; denudation nearly to sea-level, forming a peneplain, subsequent uplift to plateau altitudes, the plateau carrying Monadnock remnants and being deeply dissected in a new geographic cycle. The contrast between our northern and southern Atlantic shore-line is strikingly shown, due to submergence at the north and the emergence of marginal sea-bottoms at the south. The various features of this shore-line have determined the first settlements and the relative growth of the colonies. A characteristic passage is the explanation of such "cusps" as Capes Hatteras, Fear and Lookout, as "due to the interaction of several large back-set eddies of the long-shore waters, which seem to turn in local circuits between the Gulf Stream and the continent."

The lowland coastal areas of New England have been formed by the etching out of weak rocks, with submergence. Hence have arisen Boston, Providence and the cities of the Connecticut Valley. Water-power has mainly shaped the industry of New England, and this in turn is due to the glacial renewal of the topographic youth of the region. Following this principle of geographic control we understand the commercial superiority of New York. The middle of the older Appalachian belt of mountains is much submerged, and hence is crossed by the deep navigable channel of the Hudson;

while the Mohawk Valley offers the only deep-cut passage across the plateau that stretches from the Adirondacks to Alabama. In contrast, the Potomac has been "drowned" only up to Washington, but not across the old belt of hard rocks at Harpers Ferry, and there is no passage like that of the Mohawk across the plateau. Hence Norfolk could not have become a rival of New York. The interesting point is brought out that Philadelphia, which is also due to a depression in the edge of the continent, has expanded on open ground, and has, therefore, a large proportion of its families in individual homes.

Equally significant is the unification and swiftly developing Americanism of great and diverse populations on the broad prairies of the Mississippi Valley. The lakes and the railroads are the chief instruments in this growth. Of the latter the author writes, "Distance is their only obstacle, and that they overcome by building single tracks; they have few cuttings or embankments; they cross each other on the level, and gather in tangled ganglia in many prairie centres like Columbus, Indianapolis and Springfield." In contrast to the immense importance of railways, the Mississippi River has lost its former commercial significance, and is an impediment in transcontinental traffic. The comparatively uniform excellence of the soil in the glaciated parts of Ohio, Indiana and Illinois is set over against the sudden contrasts south of the glacial belt, where the soil depends on the underlying rocks. Thus the Blue Grass region of Kentucky adjoins the barren sandstone uplands of that State.

A short but most effective summary of the geographic factors in the astonishing development of Chicago is given. The immediate site is poor ground for a great city, but it is "the point where all overland travel from the east must turn around the southern end of Lake Michigan on the way to the great North-West." An interesting abstract is given of the newly-worked-out history of the glacial Great Lakes in their relation to Niagara. It is perhaps too brief to be well understood by the general reader, but may well arouse his curiosity to know more of a most remarkable physical history which has profoundly influenced the development of the United States and Canada. Another product of recent observations is the post-glacial diversion of much of the drainage of Western Pennsylvania, and probably even of West Virginia, from the Erie to the Ohio basin. The cities of the Mississippi River are cited as illustrations of geographic control. New Orleans is upon the lower part of its flood-plain. Memphis, Vicksburg, Natchez and Baton Rouge are at points where the river swings against its eastern bluffs. Cairo is at the entrance to the Ohio, St. Louis at the head of the flood-plain, St. Paul at the head of navigation, and Minneapolis where the Falls of St. Anthony afford water-power. The States west of the upper Mississippi are remarkable for their well-displayed and well-differentiated sheets of glacial drift. This is one of several sections in which the geographic importance of glaciation receives emphasis. Equally good exposition is given of typical areas in the Far West. Among these are the Bad Lands, the Rocky Mountains, the Colorado Plateaux, the Columbia lava plateaux, the Basin Ranges, and the Pacific Slope. The writer of this review does not hesitate to characterize this chapter as the best short account of the United States which can be found.

Space will admit of but brief reference to Mr. Tyrrell's instructive sketch of the British parts of our continent. This author has traversed widely the lesser-known parts of this northern empire as a member of the Canadian Geological Survey. The average population of Canada is less than one and a half per square mile. Most of the five millions of people are in the four south-eastern provinces. Nearly two and one-half millions of miles of northern and western territory had in 1891 less than one hundred thousand residents. The effect of environment is seldom better shown than in the fact that 14,000 boats and 27,000 men of Nova Scotia are busy with fisheries. Prince Edward Island is but one-tenth as large as Nova Scotia, but is more closely peopled than any other province of the Dominion, having 54 inhabitants to the square mile. The single province of Quebec is nearly as large as France and Germany combined. In the section on Ontario a fact is stated which is of equal or greater meaning to the United States—that a larger tonnage passes the "Soo" than goes through the Suez Canal. The contrast is well brought out between the mining provinces of the Laurentian Highlands and the great agricultural province of Manitoba, much of which is the floor of a glacial lake. An interesting contrast appears in British Columbia, which has interior regions too dry for tillage without irrigation and a coastal tract which is too wet for agriculture. A short section is devoted to Newfoundland, and a paragraph to St. Pierre and Miquelon, which are of interest as the sole remnant of French possessions in North America.

The International Geography is not exhaustive, like an encyclopedia; it is not an atlas, but it is modern, replete with information, and will be a valuable helper upon the student's table.

A. P. B.

About the Weather. By Mark W. Harrington. 12mo. New York, D. Appleton & Company, 1899. pp. 246. Illustrated. Price 50 cents.

This little book may be recommended to those who wish to learn something about the larger relations of meteorological phenomena. *About the Weather* is not at all adapted for use as a text-book, but is intended for "home reading." The author, Professor Harrington, is well and favorably known as a representative American meteorologist. With the exception of the first four chapters, which concern some of the more important of the human relations of meteorological phenomena, the book presents little that calls for comment. In general, the treatment of the subject is similar to that in other books of the same kind. The four chapters referred to are, however, somewhat unique in laying proper emphasis upon a very important aspect of meteorology. The relations of climate, and of weather changes, to man are many and varied. They have not begun to receive the attention which they deserve. It is, therefore, a promising sign when the author of the latest book on meteorology places the human relations of his science so prominently in the opening chapters of his book. *About the Weather* will give any one a pleasant hour or two of interesting and profitable reading.

R. DeC. W.

The Madeira Islands. By Anthony J. Drexel Biddle, Fellow of the American Geographical Society; Delegate, by Special Appointment, of the Associação Commercial of Funchal, Madeira, to the International Commercial Congress in Philadelphia, U. S. A., 1899, etc., etc. With Forty-seven Full-page Illustrations, a Map of Funchal, and a Section of the Medici Map, and Comprising the History of the Madeiras; Information for the Traveller and Visitor; a Treatise descriptive of the Natives, their Characteristics, Religions, Laws, and Customs; and an Account of the Commerce. Two Volumes, 8vo. London, Hurst & Blackett, Limited, 1900.

In these handsome volumes Mr. Drexel Biddle has condensed and classified the results of his long acquaintance with the Madeira Islands and their people, who seem to have won his affection. He says in his preface:

> In styling the natives of these islands Madeirans the author has furthermore departed from the custom of all previous writers on the subject, who have called them Portuguese—an appellation which the natives themselves resent.

No explanation was needed; the people of Madeira are Madeirans, and they are so called by the Portuguese. None the less they are also Portuguese, resent the appellation as they may. Exaggerated self-consciousness like theirs is the mark of small communities all over the world. "As Hull goes, so goes the State."

Mr. Biddle accepts as historical the charming legend of the lovers who discovered Madeira. The story would lose nothing, but it would gain very little, if it were recognized as authentic history to-day, to be relegated to the land of fable in a few years. As romance it is sure of perennial youth.

The ways of life, the street scenes in Funchal, the social aspects, the excursions and the natural beauties of the islands are, in a measure, reduced to tabular form by the author, so that his book might serve as an illustrated Baedeker. The statistics given are fortified by official documents and letters.

The maps and the numerous views are excellently reproduced.

OBITUARY.

William Henry Gilder.

Mr. Gilder died on the 5th of February at his home in Morristown, New Jersey, in his sixty-second year.

He was born in Philadelphia, but early in life removed to New York, where, at the outbreak of the Civil War, he enlisted in the Fifth Regiment N. Y. Volunteers. He was afterwards transferred to the Fortieth Regiment, and served until the close of the war with the Army of the Potomac.

He was commissioned captain and was brevetted major in 1864 for "gallant and meritorious services." He was wounded both at Fredericksburg and Gettysburg.

After the war, he was at one time the managing editor of the Newark (N. J.) Register.

Quiet and undemonstrative in manner, Mr. Gilder was full of daring and hardihood, and of an adventurous spirit.

In 1878 he joined the Franklin Search Expedition, as second in command under Lieut. Schwatka. This expedition recovered many of the relics of Franklin's party, and made a memorable sledge journey of more than three thousand miles.

In 1881 Mr. Gilder went with the *Rodgers* in search of the *Jeannette*, and, when the *Rodgers* was burned, he made a journey across Siberia to telegraph the news to Washington, and then took part in the search in the delta of the Lena for the survivors of the wrecked *Jeannette*.

Mr. Gilder accompanied the French army in Tonkin as a war correspondent in 1883, and after his return to America devoted himself to newspaper work.

He published in 1881 his account of *Schwatka's Search*, and in 1883 the story of his Siberian journeys, under the title of *Ice-Pack and Tundra*.

NOTES AND NEWS.

THE OFFICIAL *Bericht* of the Seventh International Geographical Congress prints the following Resolutions, in addition to those published in BULLETIN No. 5, 1899:

OCEANOGRAPHY.—The Congress considers the Resolutions of the Conference on International Oceanographical Research, held at Stockholm in June, 1899, to be so important for the advancement of Oceanography in general, that it desires to make to the Governments represented at that Conference an urgent appeal that these Resolutions should be carried out in their entirety.*

MAPS OF PREHISTORIC REMAINS.—The Congress considers it highly desirable that maps should be constructed showing the distribution of the dwellings and burial-places of the so-called prehistoric peoples, with the greatest possible amount of discrimination of the respective periods of the remains. It directs the attention of the approaching Archæological and Prehistoric Congress, to be held in Paris in 1900, to this question, and relegates to that Congress the appointment of an International Committee on the subject.

Proposition to be amended at the next Congress:

TRANSSCRIPTION OF NAMES.—The Congress expresses the desire that the question of the transscription of place-names should be brought up for consideration at the next Congress.

THE LIST OF INTERNATIONAL CONGRESSES to be held during the Paris Exposition, this year, numbers 106. Those more or less directly related to Geography are the Congress of Mountaineering, the Congress of Americanists, the Colonial Congress, the Congress of Ethnographic Sciences, the Congress of Economical and Commercial Geography, the Geological Congress, and the Congress of Colonial Sociology.

THE CATALOGUE OF PERUVIAN EARTHQUAKES, begun in the *Boletin* of the Lima Geographical Society, Tomo VIII, Trimestre Tercero, is concluded in Tomo IX, Trimestre Primero.

The catalogue begins with the year 1513, and is brought down to 1878, and it notes more than 2,500 earthquakes, 215 of which occurred in the sixteenth century, 27 in the seventeenth, 852 in the eighteenth and 1,452 in the nineteenth. It is evident that there was no attempt at careful registration of these phenomena before the year 1700, and such records as exist must he sought for, according to Señor Polo, who compiles the catalogue, in rare or even in unpublished works on various subjects, in the chronicles of religious bodies, in the lives of holy men, and in theological or literary treatises.

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* The Conference referred to assigned to the nations bordering the Baltic, North and Arctic Seas areas for simultaneous investigation of the waters at the beginning of February, May, August and November, at which periods the greatest changes take place in the waters. The Governments represented were: Finland, Russia, Germany, Sweden, Denmark, Norway, The Netherlands and Great Britain.

With regard to the frequency of shocks, Señor Polo quotes the statement of Father Cobo, in the middle of the sixteenth century, that no year passed without an earthquake in Peru and Chile, and the calculation made by Dr. Fuentes, that in the period between 1815 and 1858 there were eight more or less violent earthquakes every year in Lima. This city and Arequipa seem to be the principal centres of activity—the former with a record of 923, and the latter with one of 1377 convulsions.

NEARLY ALL THINGS ARE OLDER than they seem to be. The *Bulletin* of the Paris *Société de Géographie Commerciale* (Vol. XX, p. 674) discovers that commercial geography, regarded by many as a recent creation, was cultivated by at least one original mind in the eighteenth century. There is no resisting the evidence of this quotation from the sign of a barber-surgeon of the time:

> I teach joggraphy and foreign merchandise every Wednesday and Friday. With the help of God, by me, Isaac Macaire.*

Genius is hereditary in the Macaire family, and Isaac, not content with teaching commercial geography, seems to have preceded the National Educational Association in the flowery path of spelling reform.

THE IMPERIAL UNIVERSITY OF TOKYO prints in the *Journal of the College of Science*, Vol. XI, Part IV, the Catalogue of Japanese Earthquakes between the years 416 and 1867, compiled under the superintendence of the late Prof. S. Sekiya. Counting as one each great earthquake with its after-shocks, the number during the 1451 years amounted to 1898.

Dr. F. Omori, in his Notes on the Catalogue, recognizes three classes of earthquakes:

1.—*Great* or *destructive*, in which the ground was cracked, buildings greatly damaged, lives lost, etc.;

2.—*Strong*, in which slight damage was caused, such as cracks in walls, etc., and people were alarmed;

3.—*Small* or *slight*, in which the motion was felt, without resulting alarm or damage.

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* J'enseigne Joggraphy et marchandises étrangères tous les mercredi et vendredi. Dieu aidant, par moi, Isaac Macaire.

Dr. Omori counts two hundred and twenty-two destructive earthquakes in Japan to the end of the year 1898.

He regards the earlier records as imperfect, but relies upon the accuracy of those from the beginning of the seventeenth century to the present time, and he calculates that for the 299 years ending with 1898 there were in Japan one hundred and eight destructive earthquakes, or one in about every 2½ years.

He finds that the provinces on the Japan Sea, or concave side of the arc formed by the islands of the empire, have been disturbed almost exclusively by *local* shocks; while those on the convex, or Pacific side of the arc, often suffered great *non-local* shocks, originating in the ocean and sometimes accompanied by fearful sea-waves.

Kyoto, the capital for 1070 years, from 797 to 1867, has a record for that period of 1,308 earthquakes, 34 of which were destructive. Two of these sometimes happened in one year, and there have been intervals of 50 and 100 years without one.

Dr. Omori's Notes are illustrated by 23 analytical tables and 12 plates of seismic frequency and distribution.

TRANSACTIONS OF THE SOCIETY.

JANUARY–FEBRUARY, 1900.

The Annual Meeting of the Society was held at Chickering Hall on Monday, January 22d, 1900, at 8.30 o'clock P.M.

The chair was taken by Vice-President Moore.

Seats on the platform were occupied by members of the Council and by the following invited guests: Hon. Abram S. Hewitt, Hon. Joseph F. Daly, Hon. Geo. C. Barrett, Mr. John E. Parsons, Mr. Paul B. Du Chaillu,

Hon. Morgan J. O'Brien, Mr. B. Moynahan,	representing the Friendly Sons of St. Patrick;
Mr. Stephen M. Wright, " Douglas Taylor, " John H. Waydell,	representing the General Society of Mechanics and Tradesmen;
Hon. Addison Brown, " Seth Low, Mr. D. O. Mills,	representing the New York Botanical Garden;
Dr. H. H. Rusby, " T. F. Allen, Prof. N. L. Britton,	representing the Torrey Botanical Club.

The following persons, recommended by the Council, were elected Fellows:

J. Wheeler Hardley,
C. W. Haskins,
Richard A. Hudnut,
Theodore W. Moses,
Aymar Embury,
C. G. Crawford,
Wm. C. Le Gendre,
F. G. Goodrich,
Albert Delafield,
Edward Harding,
F. Benedict Herzog,
Roswell Eldridge,
Henry Van Holland,
Frank Lyman,
Nikola Tesla,
Fordham Morris,
Jeremiah Evarts Tracy,
George Turnure,
W. D. H. Washington,
Edward H. Cole,
John Henry Timmerman,
Wm. Paul Gerhard, C.E.,
Morris Loeb,
W. J. Bormay.

The Annual Report of the Council was presented and read:

NEW YORK, January 6, 1900.

To the American Geographical Society:

The Council respectfully submit the following report for the year 1899:

The number of Fellows on the 1st of January was 1,179. The additions during the year number 68. The losses by death, resignation, etc., were 83, and the total

Fellowship on the 31st of December was 1,164, of which number 297 were Life Fellows.

The additions to the Library number 3,588, viz.: Periodicals and Pamphlets, 2,465; Books, 853; Maps and Charts, 258; Atlases, 12. Among the acquisitions may be mentioned the Report of the Intercontinental Railway Commission, in seven volumes, quarto; the continuation of Lanciani's great topographical map of Rome, and a set of Zeiller's Topographies, in 11 volumes, folio.

On the 1st of December the Council received an excellent portrait of our late President by Harper Pennington, a present to the Society from a number of subscribers.

For the condition of the finances reference is respectfully made to the report of the Treasurer, herewith submitted.

The Council, deeply impressed with a sense of the insecurity of the valuable library and collections in the present home of the Society, and convinced that the necessity of the case called for action, issued in February last a circular letter to the Fellows, setting forth the facts and inviting contributions to the Building Fund.

In response to this appeal the following subscriptions were received :

Joseph Loth	$250.00
William A. Du Bois	250.00
Herman O. Armour	1,000.00
Rev. E. A. Hoffmann	250.00
Herman C. von Post	1,000.00
Seth Low	250.00
Chandler Robbins	1,000.00
Rev. D. Stuart Dodge	200.00
George Watkinson	100.00
Henry Parish	5,000.00
James J. Higginson	250.00
James J. Hill	100.00
John D. Archbold	1,000.00
Morris K. Jesup	1,000.00
James B. Ford	2,500.00
Anton A. Raven	1,000.00
William C. Schermerhorn	1,000.00
John A. Hadden	1,000.00
Walter R. T. Jones	250.00
D. O. Mills	5,000.00
William C. Whitney	250.00
Gustav E. Kissel	500.00
Chas. P. Daly	5,000.00
Francis M. Bacon	1,000.00
Moses Pierce	300.00
Amounting to	$29,450.00*

These subscriptions, though generous in individual amounts, were in the aggregate disappointing, and it is hoped that others may yet be received.

The Council proceeded, however, to purchase two lots of land, each 25 x 102 feet, in West 81st Street, facing Manhattan Square, which were held, after mature consideration, to be in every way most desirable for the purposes of the Society.

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* Since the Report was made, a subscription of $250 has been received from Mr. James Douglas.

Plans for a new building have been drawn by the architects, Messrs. Howells and Stokes, and are being carefully studied by the Council; the problem being how to construct, with an inadequate fund and without incurring indebtedness, such a building as shall meet our requirements for the future as well as for the present, and constitute, at the same time, a worthy addition to the noble edifices of the city.

The lots have been excavated for the foundation, and it is expected to begin the work of construction in the spring of this year.

All of which is respectfully submitted.

HENRY PARISH,
Chairman.

LEVI HOLBROOK,
Secretary.

The report of the Treasurer was then presented and read:

AMERICAN GEOGRAPHICAL SOCIETY.

GENERAL ACCOUNT.

REPORT OF THE TREASURER FOR THE YEAR 1899.

The Treasurer respectfully reports that on January 1st there was in Union Trust Co.		$1,982 13
During the year there have been received from Fellowship Dues, Sales of Publications and interest on invested funds		17,826 29
		$19,808 42
There have been expended for salaries, Library, Publications, Meetings, House a/c, Explorations, Insurance, Postages, &c., &c.		12,423 34
		$7,385 08
There have also been received from Sales of investments	$59,700 00	
Donations to Building Fund	29,450 00	89,150 00
		$96,535 08
And there has been paid for two lots on West 81st Street, and for taxes and charges thereon		91,380 81
On December 30 there are in Union Trust Co.		$5,154 27

WALTER R. T. JONES,
Treasurer.

NEW YORK, December 30th, 1899.

The Committee charged with the duty of selecting candidates for the offices to be filled, made the following report:

To the Council of the American Geographical Society:

The Committee appointed to recommend to the Society suitable persons to be elected in January, 1900, to fill vacancies now existing and then occurring in the offices, respectfully reports:

That as a tribute of respect to the memory of Judge Daly, it asks leave to defer for the present any recommendation to fill the office of President, left vacant by his death: and

It recommends the election of the following-named persons to the offices designated:

W. H. H. MOORE—for Vice-President, term to expire in January, 1903.

PROF. W. LIBBEY—for Foreign Corresponding Secretary, term to expire in January, 1903.

WALTER R. T. JONES—for Treasurer, term to expire in January, 1901.

FRANCIS M. BACON,
JOHN GREENOUGH,
ALEXIS A. JULIEN,
S. NICHOLSON KANE,
D. O. MILLS,
} for Councillors, terms to expire in January, 1903.

HENRY PARISH, Chairman,
CHANDLER ROBBINS,
LEVI HOLBROOK,
Committee.

NEW YORK, January 6, 1900.

It was moved and seconded that the Chairman should name one Fellow to cast the vote of the Society for the candidates, and the Chairman named Mr. A. A. Raven, who cast the vote accordingly, and the candidates were declared duly elected.

The Chairman then announced that the Annual Meeting had been selected as an appropriate occasion for the commemoration of the life and services of the late President of the Society, Charles P. Daly, and added:

One or two facts, within my own knowledge, briefly stated, may interest you.

Fifty-six years ago it was my privilege to see him presiding as Judge in the Old City Hall. He was a young man, of slender form, and it was well known that his opportunities for preparation had been very limited. Some of the older lawyers looked upon him with grave apprehensions as to his success. His tireless industry, energy and perseverance soon put at rest their fears.

About ten years after his appointment as judge he joined this Society for recreation and pleasure. His long walks, between his home and the Court room, gave him exercise, health and vigor, and as I have heard him state, a good old age. In his leisure hours he took great delight in geographical studies. He little imagined that he would attain a world-wide distinction as a geographer. This Society at that time was very small. The eloquent Dr. Hawks, George Bancroft and Henry Grinnell were among its prominent members.

As to Judge Daly's amiability and good temper I may state that in one of his judicial decisions he spent much time and thought in writing an opinion. It was on an important commercial question, and was considered so able and excellent that copies of it were printed in pamphlet form and widely circulated. Unfortunately the decision was reversed by the highest Court in the State. Sincere regrets were expressed to Judge Daly that so valuable a decision, supported by such clear and conclusive reasoning, should go for nothing. He said he made it a point not to have any feeling over such a result, and he uttered these words with much gentleness and equanimity. I am bound to say that two of the ablest Judges of that highest Court, one from New

York and one from Brooklyn, agreed with Judge Daly and wished to sustain his decision.

Judge Daly in the closing years of his life was so well known as an authority in geographical science, and was so highly respected, that a letter of introduction from him to the leading Geographical Society of the world—I refer particularly to the Royal Geographical Society of London—would secure to the bearer all the consideration and attention he could reasonably desire.

The Chairman then introduced Prof. William Libbey, who spoke as follows:

Nations magnify their heroes, and communities their faithful citizens. We meet to-night to express our veneration for a well-spent life, and I appear before you out of esteem for Judge Daly, and respect for your request that I say a few words concerning his life and work in connection with this Society.

Whenever death occurs there comes a break in the course of our thoughts, which causes a solemn feeling to take possession of us. That wondrous veil which separates us from what is beyond checks even our spirit's flight as with a sword's keen tip. We may have walked in closest and kindliest intercourse with our friend up to this point, but here the way is barred, and the unaided human eye, peering out into the darkness, feels no responsive ray of light.

The longer the friendship has lasted, the deeper the meaning of fellowship, the richer the life, the greater does the void appear; and the chill of that fathomless ocean of the unknown strikes us back with a sigh upon its shore,—no matter how deeply we realize that it is not the barrier, but the gateway to eternity and immortal life.

That a man should rise from the ranks to eminence, in this country, is no new thing, but such development usually takes place along some single line. How often is it true that the broader elements, known as the humanities, are lacking in such growth!

I shall leave the story of the youth, the early struggles, and the success which crowned the efforts of Charles P. Daly in his chosen profession to abler lips than mine. It is my duty to give you a glimpse of his character from another standpoint,—that of the scientific man.

The hardships of poverty, and the roughness of the forecastle, may make a "man" out of good material, but do they always produce a scholar or a polished gentleman,—a friend of great men, the associate of men of letters? Neither do they always produce a geographer; but I do not hesitate to say, that in this particular case they may have excited the curiosity first, and then the profounder interest which characterizes the true student of nature. Judge Daly had certainly cultivated all the virtues of a man of science, which find their highest reward in the possession of truth. He was an ardent and devoted lover of nature, and this craving for truth, which made him modest in his opinions and cautious in his statements, pervaded his character like the breath of life.

He was full of enthusiasm, even in his old age, over each new discovery, and every advance of science brought him fresh enjoyment.

Alexander von Humboldt said of him in 1851, "Few men have left upon me such an impression of intelligence on subjects of universal interest." Such being the case, it may be interesting to go back to those early days in his connection with the Society and discover, if possible, the sources from which the inspiration of this life took their rise, which so soon made him the President of the Society, and enabled him to fill that office so acceptably for thirty-six years.

We must remember that it was a formative period in geographical science. The teachers of that time had not yet really felt the power of Humboldt's life ; Ritter and Guyot were just beginning their pioneer work, which was to lead the way from what might be called the domain of imaginary geography to a better understanding of the subject. Those were the days in which such strangely fantastic ideas as the existence of Symmes Hole were seriously and gravely discussed. It may seem odd, but we do not have to go back a quarter of a century in our history as a Society to find one of our most distinguished members describing with great zeal at one of our meetings the open Polar Sea. It may have had its purpose in covering up the unseemly void left by the collapse of Symmes Hole, but I doubt if it could be anything more than a graceful retreat from that untenable theory.

Judge Daly, with his logical mind, intent on gathering exact facts, could not possibly be satisfied with such subtle and filmy dreams, and his whole career was a silent reproof of such "easy chair" investigations. The facts, and nothing but facts, as the firm basis for true scientific knowledge, were what he sought, and he believed that they could be best accumulated through the agency of such an association as ours.

Judge Daly's interest in the Society dates from the year of its foundation, as he became a member on February 15th, 1855. His connection with the Society must have been a vital one, as he was elected a member of its Council on December 2nd, 1858.

Shortly after this time, in 1859, he presented his first book to the Society—a most characteristic act, which was repeated throughout his life, as there has been one long line of such gifts from that time to this. In this way an ever increasing-influence for good was started, as he was undoubtedly most instrumental in securing our large library, which ranks high among the world's collections upon geographical subjects.

Soon after this we find him reading some masterly remarks before the Society upon a letter from D. O. King, on a trip to Siam; in the course of which he shows a keen appreciation of the new facts brought out by the letter.

These two incidents illustrate to my mind the typical points in his character, while they show his deep interest in the Society as well. He was not content with gifts merely. His spirit longed for the benefit to be derived from study. He had what might be called a practical habit of mind. It made him strive to do something of lasting good in what he undertook, and it kept him from trifling and self-seeking.

In the same year, upon the occasion of the Humboldt Commemoration, he voiced the sentiments of the Society concerning that eminent geographer in words which are almost prophetic of his own career. I should like to read some of the sections of those resolutions, as I believe they fully represent our feelings at this time :

"*Resolved*, that we do not assemble to indulge a sentiment of regret at the termination of a life, which the great Author of the universe extended beyond the ordinary limit, but to express our sense of what that life has accomplished, and of the noble example it presented to the age which it adorned, and to all future time ;"

"*Resolved*, that his intellectual preëminence is heightened by the beauty of his private life, his disinterestedness and gentleness, his ready sympathy with and encouragement of all who sought his aid or counsel, his strong faith in the future of humanity, and his manly love of liberty as an element of human progress."

At that time Judge Daly was already spoken of as "one who needed no commendation before this Society, since he devoted so much of his time, his means, and his counsels to its prosperity." He was evidently a self-made man in a very high sense—he was shaping and broadening his spirit, and his life thus became a means to a lofty end.

After the troubled times of the Civil War, when the existence of the Society seemed to be imperilled, he was the means of arousing new interest on the part of our citizens, and with the aid of the venerable Peter Cooper he brought new life to the organization.

His contributions to the intellectual progress of this Society, and of the community, were many and varied. He was a master in the use of his time and opportunities, and his researches enabled him to produce papers of value and interest along several different lines.

His first annual address upon the subject of geographical progress was read in January, 1873, and many more followed it. That was the year of a great revival in all lines of geographical research. The great western expeditions, which did so much to develop that section of our country, were beginning to bear fruit, and new Arctic explorations were being made. All these appealed strongly to him, and he emphasized with pardonable pride the fact that they were American.

We find, however, that he was not content with merely summarizing these purely geographical results, but that every subject relating to the study of the earth as a whole attracted his attention. The progress in Geology, Astronomy, Meteorology and Archæology was also watched, and the most important facts were gleaned for his papers.

Nor did this satisfy him. The Journal of the Society evinces many evidences of his activity in the domain of historical geography. Papers upon the "History of Physical Geography," "The Early History of Cartography," "Stanley's Verifications of Ptolemy's Geography," and kindred topics, were presented, in addition to what might be called the routine work of the geographer. Great practical works, such as the Suez and Panama Canals, the draining of the Zuider Zee, etc., were considered, and he was often the means of bringing about a symposium upon some subject of immediate interest when leading authorities would present their contributions in short public addresses. The many and famous gatherings of this nature upon the subject of Arctic work need only be alluded to in this connection as an illustration of his successful method of bringing about popular interest in an attractive manner.

Surely all these forms of activity, the organization and furthering of the objects of this Society, the prosecution of investigations on his own part and the inciting of activity on the part of others, as well as the formulation and carrying out of a policy which has placed our Society upon a solid basis, are to be classed as geographical work of a high character.

His interest in geography was not, however, merely theoretical. He took a lively interest in the men who devoted themselves to exploration. They were always welcome guests at his table, and he aided them with both advice and money. Many explorers and scientific men have been entertained at his hospitable home, and whenever honest and adventurous men sought his advice, they were sure to find him ready with encouragement and inspiration.

He was peculiarly genial. To his personal qualities he owed much, and no one came into close contact with him without feeling the magnetic power of his life.

What is the lesson of such a life if not the inspiration to future work? Under such an impulse do we not feel a deeper sense of duty and a keener appreciation of the opportunities of life?

If I were to review the history of this Society, which, in a large degree, is the history of the life of Judge Daly, I should divide it into three parts:

First, the early period of the struggle for existence, from 1854 to 1876. This term of years ended in the secure establishment of the Society in a home of its own, with an almost unrivalled collection of books and charts.

A second period of twenty-two years brings us to the time when the Society, by the gradual accumulation of the necessary funds, felt able to provide a suitable building for its purposes. No public aid brought about this result. It has been such a quiet growth that but very few of even our members know the position attained by the Society as the reward of careful planning. Much more remains to be done, however, before we can enter upon the true labors of such a Society and realize the full possibilities of our corporate existence.

The third epoch we have now entered upon, and I feel sure that if Judge Daly could say one word to us to-night, it would be to urge us to carry out the spirit of the motto of Prince Henry, the Navigator, "Talent de bien faire"—to cultivate the ability to be useful.

Geography can no longer, as in the past, be represented by a bent figure gazing into the unknown, puzzled by all it sees, but by a form, straight and erect, bearing aloft a torch, lighted to aid in the full study and development of our earth. The part we will play in this progress remains for us to determine.

The long and useful career of Judge Daly is ended. His genial and patriarchal figure will no longer be seen among us, but his spirit must live in our midst.

The Chairman then invited the Hon. Abram S. Hewitt to address the Society. Mr. Hewitt said:

I almost fear that the extemporaneous remarks I may be able to make will impair the pleasant impression left by Prof. Libbey, who has in such fitting terms described the value and beauty of Judge Daly's life. I think I must have known him longer than any one in this hall. He was but six years my senior, so that I may say I have known him all my life—certainly for more than sixty years. I did not know him when he was a boy attending the school of Alderman Brady, in company with James T. Brady, afterwards so distinguished at the bar, and with John McCloskey, who subsequently became Archbishop and a Cardinal in the Catholic Church. These eminent men, however, were never tired of recalling his sweet and lovely temper and the promise of his boyish days. It was true that he was born of humble people, but, if he had been rocked in a royal cradle and nurtured in the lap of luxury and refinement, he could not have had a loftier soul, and his character and his life would have been an honour to any family, however elevated and powerful.

I first saw Judge Daly at a meeting of the New York Literary Society, which had just been founded, and included all the rising young men of the day. The meetings were held in Apollo Hall, and I had been invited to attend some of them in order to take lessons in debate. Certainly the young men who formed the society justified their youthful reputation by their subsequent success. Besides Daly there were Samuel J. Tilden, Elijah Ward, Theodore Tomlinson, Lorenzo B. Shepard and, most prominent of all, McElligott, who was a teacher in the school of Forest and Mulligan, then the leading boys' school in New York.

When Daly rose to present his side of the argument on that evening he talked for three hours. The subject was handled from every possible point of view, and nothing of importance was left out. I remember well the masterly manner in which he dealt with the matter under discussion. He was answered by Tilden, who also talked for three hours, in order to do justice to his side of the question. The young men of that day were certainly giants in talk, if in nothing else. After the close of the discussion I was presented to Daly, and I remember his friendly manner and his willingness to give me advice as to how to handle questions in debate. He was then a young man of about twenty-one.

Of his early life he seldom spoke, even after I began to know him very intimately. We have spent many hours, days and weeks together in the privacy of his house and of my own. Once or twice he alluded to his experience in the merchant service, and I could see that his nature, innately refined and gentle as it was, must have suffered keenly under many a rude shock, and possibly from rough unkindness. The loss of his parents so early in life must have made things exceedingly hard for him; and that he was able, having had but a limited training in school and no other education but such as he acquired by his own unaided efforts, to rise by steady progression to the position he held in the world, is proof of his great gifts and of a strength of will which enabled him to overcome all obstacles.

His sense of honour, too, was of a very lofty kind. When the opportunity was given to him to advance himself by entering the office of a lawyer, who saw the promise of great things in him, he declined to take advantage of the opportunity until the term of his apprenticeship to the carpenter's trade was finished. The man to whom he was apprenticed had died, but the widow needed his services, and Daly's sense of duty kept him firmly to the obligation which he felt that he owed to a helpless woman.

In all his experience of life one thing was very remarkable—the harder his lot was, the more gentle and lovable he became. His knowledge was wide, and he improved every opportunity to add to it. He was in the truest sense a self-made man. If I were speaking to an audience of young people, I would hold Judge Daly up as an example—an inspiration, so to speak—because his life has shown what may be done by perseverance, integrity and courage in the face of obstacles which would deter most men and be a hindrance to success. Of course, he was not an ordinary boy, but one with peculiar and great gifts, to which, however, he was absolutely loyal, so that it may be said of him that he never wasted time or trifled with the talents which he possessed.

Prof. Libbey has spoken of his great services to the American Geographical Society. They cannot be overrated. It is perfectly true that to Judge Daly, and to him only, the Society owes its resurrection. He joined it in the first year of its existence, and soon took a prominent part in its transactions. When the Civil War came on, however, interest in scientific bodies naturally diminished, so that in 1860 it seemed as if the Geographical Society would be abandoned. I well remember his saying to me on one occasion:

"The Geographical Society is, I fear, dead. It has no money and no place in which to house its valuable library of books. We will give them to the Cooper Union, where they will be accessible to the public."

I advised him not to do this, but offered to house the books until such time as interest in the work of the Society might be revived and a home of its own be secured. He accepted the offer, and for about five years the books were kept in one of the alcoves of the Cooper Union, where the Society used to maintain a feeble existence. When the war was over, however, Judge Daly and his associates were able to revive the public interest in the work of the Society and to raise the funds required for the purchase of its present home. In this it was the privilege of Mr. Cooper and myself to assist.

On all geographical matters Judge Daly was a recognized authority. He was as well known abroad as at home, and when the great International Geographical Congress was held in Europe in 1895 he was chosen by unanimous consent to make the reply to the opening address of the Duke of York, the presumptive heir to the English throne. I was not so fortunate as to be present, but I was in Europe at the time, and I heard from others that the scene was most impressive and remarkable. It is certainly memorable that the representative of our country on that occasion, delegated by the older nationalities to reply to the Prince, should be a man born in poverty and who owed his position to the favourable influence of free institutions. I refer to this matter here for the sake of recalling the wonderful dignity of character which Judge Daly manifested on all public occasions, and his insensibility to the deference due to rank and power. He was a gentleman to the manner born, and moved among men as the unconscious equal of nobles and princes.

Judge Daly was interested and well informed on all subjects of art and science. He was fond of poetry, he loved the fine arts, and enjoyed music, and in all of them he was more than a critic. Gifted with an unusually sweet and expressive voice, his singing was a treat to those who were permitted to enjoy it. When Thackeray came to America to lecture on the "Four Georges," it was my good fortune to meet him and the late C. P. Cranch at the Century Club after the lectures were over. Thackeray and Daly both had clear, low tenor voices, and the Judge would sing the Irish melodies he knew so well in a way to touch the heart most deeply. Thackeray would follow with those songs which have been preserved, such as "Little Billee" and the "Bouillabaisse," while Cranch, who, singularly enough, was gifted with the same kind of voice, would give us the melodies of our own country. The memory of these evenings spent in such company is very dear to me and will go with me to the grave. Ah! noctes cœnæque deûm.

Of his judicial career it is not necessary for me to speak. Others better qualified will testify to his long and honourable service upon the bench. I will refer, however, to his appointment to the Common Pleas at the early age of twenty-eight years. He had been a member of the Assembly, where he had gained the confidence and respect of Governor Bouck, who at that time made the judicial appointments. The term of Judge Inglis was about to expire. He was a candidate for reappointment, and his ability and reputation certainly entitled him to have his wish gratified. The Governor, however, was obstinate, and insisted upon appointing Judge Daly to the position. He promptly declined the offer and urged the Governor to reappoint Judge Inglis. The matter caused considerable discussion at the time, and certainly the general judgment of the Bar was that the Governor was wrong. Nevertheless, when it became apparent that he would not recede from his position, Judge Inglis personally requested Daly to take the place, and at length the latter consented and began his judicial career with fear and trepidation. The result, however, certainly justified the good opinion of the Governor. It happened that Daly sat longer upon the bench than any man of his day and generation. No one could have been more diligent and certainly no judge of our time has given greater evidence of learning and that breadth of intellect which is the essential quality of a great judge. After the position became elective, and at a time when party feeling ran very high, and when it was said that Tweed had decreed his dismissal, Judge Daly was re-elected by the unanimous vote of his fellow-citizens—a result which had never before and has never since occurred in this city. His retirement from the bench was a subject for general regret, and during the remainder of his life he occupied a position among his fellow-citizens almost unique. I happened to know personally that offers of public employment in conspicuous positions were made to him, but he preferred to pass the evening of his days in the quiet of his home, in the enjoyment of his library and the performance of such general duties as fall to the lot of citizens who become sages and are classed among the grand old men of the time. Certainly Judge Daly was happy in the last years of his life, so long as Mrs. Daly survived. Their union was a very perfect one, and the blow which left him alone manifested itself, as we all could see, in the decay of that vitality which had enabled him to accomplish so much useful work in the world.

Perhaps I ought to speak of the part which Judge Daly played in many of the most important political events of our time. During the Civil War he was constantly called in consultation by President Lincoln, Secretary Seward and Secretary Chase. His advice at critical moments was decisive, and his influence among the representatives of foreign powers, with whom he was on terms of intimate association, was of the greatest value. I doubt whether any man at that time wielded a more powerful and conservative influence than Judge Daly, and in the final work of reconstruction, his voice was always on the side of generous treatment toward the States who had sacrificed everything for what they believed to be right. The generosity of Judge Daly was conspicuous in the trying times for the South, which followed the close of the war. His house and his table were always open to his Southern friends, and they were made to feel that they were welcome, not merely to the hospitality, but to the generous consideration of their fellow-citizens of the North.

On the whole, I think I may say that no citizen of New York has ever led a more useful life, or left a more lovable name behind him, than our departed friend. He was an embodiment of sweetness and light, and I think I am justified in saying

None knew him but to love him,
Nor named him but to praise.

At the close of Mr. Hewitt's remarks, Prof. N. L. Britton, Director of the New York Botanical Garden, was introduced and spoke as follows:

Judge Daly was extremely fond of plants, trees and flowers; not only from the æsthetic standpoint of natural beauty, but he also had a profound appreciation of the uses of plants and their products, and of the more abstruse scientific questions of botany as well. I have talked with him along all these lines, and while he always disclaimed being a botanist, the conversation showed that he was well informed in a broad way about many of the problems of modern biological science. Plant distribution and plant utility were probably the topics which interested him most, owing to their intimate relationship to geography and economic science.

Both Mrs. Daly and the Judge were active participants in the movement, commenced in 1888, for the establishment of the New York Botanical Garden, which now, through their efforts and those of other public-spirited and philanthropic men and women, is rapidly developing, with the cordial co-operation of the City, into a noteworthy institution. Mrs. Daly was an influential member of the Committee from the Torrey Botanical Club which guided the movement, secured the necessary legislation, and raised by subscription a quarter of a million of dollars as a permanent endowment fund, in advance of any construction work being begun. Judge Daly threw all the weight of his irresistible personality and his trenchant argument into the endeavor, and subscribed liberally to the endowment. The early meetings of those most earnest in the movement were held at his residence, and he published a pamphlet for private distribution entitled "The Need of a Botanical Garden in New York," which was of very great assistance in informing others of the scope of the Committee's aspirations.

In the disposition of their estates both he and Mrs. Daly made most generous provision for the Botanical Garden, and it may be safely asserted that few have done more for botany in New York than our lamented friends.

They are commemorated in botany by a small but beautiful sunflower, which I found, in company with the Judge, while exploring in the vicinity of his country-place at Sag Harbor, and which I have described and dedicated to them under the name of *Helianthus Dalyi*.

Mr. John E. Parsons, President of the Association of the Bar, came forward on the invitation of the Chairman, and said:

"May I add a few words with particular reference to the simplicity and ingenuousness of Judge Daly's character? He was a most learned man, thoroughly versed in literature and law, philosophy, science and art. His learning did not consist in a mere smattering about a great many subjects. It was profound and exact. And he had a memory which never forgot. In contrast with this was an openness, a cordiality, a genuineness which were most attractive. I remember Judge Daly during a large part of his judicial life; from the time when I looked up to him with the awe and reverence with which a young lawyer regards a judge down to a later period when I was honored with his friendship and was permitted by him to meet on equal terms. From the beginning I was impressed with his kindness, the consideration which he showed to younger men, his patience and his unruffled amiability. In the summer of 1880 I was travelling in Europe with my family, and to the hotel at Munich where I was staying came Judge and Mrs. Daly. We were together for several days, visiting the many objects of interest and on occasion going to a concert hall or beer garden. The Judge was like a child, delighted with everything, interested in everything, appreciative and genial to the last degree. He knew more about beer than a brewer, about art than a painter, about music than a professor.

I do not see how it was possible for anybody to be brought into close relation with him without being drawn to him by the warmth of his sympathetic nature. He came occasionally to Lenox, where I spent my summers. I think that it was always a question whether in leaving he would remember to take his belongings with him. I am very sure that there was one, and perhaps more than one occasion when his keys went astray or his return railroad ticket was mislaid, or something else was missing. Even this was characteristic. He was a delightful companion, always willing to listen, never making a parade of his learning, interested in all the ordinary events of life, unassuming as a boy.

I ought not to close without a few words about Judge Daly as a lawyer. In a notable case argued subsequent to his retiring from the Bench he was with me as counsel. It had been thought better by those who were associated in the case that it should be suggested to the Judge that in his argument he should be as succinct and as directly to the point as was possible. His brief and his argument were models of condensed and direct reasoning. It was a surprise and a delight to me that it was possible for him to put in so small compass such a wealth of discussion. I took occasion to tell him so. He was pleased with all the ingenuousness of a child.

The place which Judge Daly's death left vacant it will be difficult to fill. Especially is that true here. It is not only because of the vastness of his information and his active and exceptional interest; it is as well because of the loveliness and the dignity of his character, which impressed all who were brought into association with him. New York may well mourn her loss.

At the conclusion of Mr. Parsons's address, the Chairman introduced Mr. Paul B. Du Chaillu, who spoke briefly of all that he owed to Judge Daly's recognition of his work as an explorer, and gave a few reminiscences which illustrated the Judge's interest in every phase of life and character.

On motion, the Society adjourned.

A regular meeting of the Society was held at Chickering Hall on Monday, February 19, 1900, at 8 o'clock P. M.

Vice-President Moore in the Chair.

The following persons, recommended by the Council, were elected Fellows:

Walter Jones Hewlett,
Herbert L. Bridgman,
Alexander Graham Bell.

The Chairman introduced Mr. T. C. Mendenhall, President of the Worcester Polytechnic Institute, who addressed the Society on the subject of the Alaska Boundary.

On motion, the Society adjourned.

BULLETIN

OF THE

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Vol. XXXII **1900.** **No. 2**

THE PHYSICAL GEOGRAPHY OF NEW YORK STATE.

PART XI.—THE CLIMATE OF NEW YORK.

BY

E. T. TURNER, Ithaca, N. Y.

BASIS FOR A STUDY OF NEW YORK CLIMATE.—The State of New York affords an exceptionally favorable and interesting field for the study of climate, owing to the diversity of its physical features, as well as to the wide variety of atmospheric influences to which it is subject. It is not surprising, therefore, to find that the first organization for local climatic observation in America was that inaugurated in 1826 by the New York Board of Regents at numerous academies under their supervision, and which was continued without a break at several stations until 1863. After that time meteorological records were maintained by a few scattered observers co-operating with the Smithsonian Institution; and in 1870–71, five fully equipped stations were established in the principal cities by the U. S. Signal Service.

The State Weather Bureau was created by act of the Legislature in 1890, and, with the aid of over one hundred voluntary observers, its work was carried on for ten years, when the organization passed under the control of the National Weather Bureau. A great mass of data has thus been accumulated for the use of the climatologist, and may be found in the various publications mentioned in the footnote*; but in view of the improvements which have of late years been made in instruments and method of observation, the investigator will find it best to depend upon the later observations, as far as practicable, and especially so when *dealing with temperature values.*

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* 1—Essay on the Climate of New York, by F. B. Hough, Albany, 1857.

2—A Letter on the Climate of New York, by J. H. Coffin, contained in the "Natural History of New York State," Albany, 1843.

General Features of Climate.—Glancing briefly at the general features of terrestrial climate and air circulation which govern and include our local conditions, we have first to consider the effects of geographical position upon temperature, as shown in the accompanying isothermal charts of the northern hemisphere. The

* ISOTHERMAL LINES OF THE NORTHERN HEMISPHERE AND WINDS OF THE UNITED STATES.

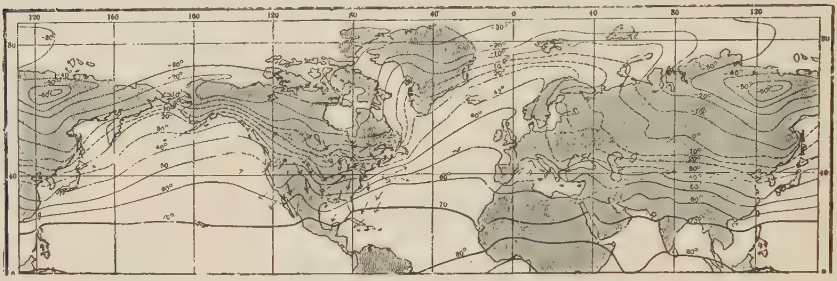

FIG. 1.—JANUARY.

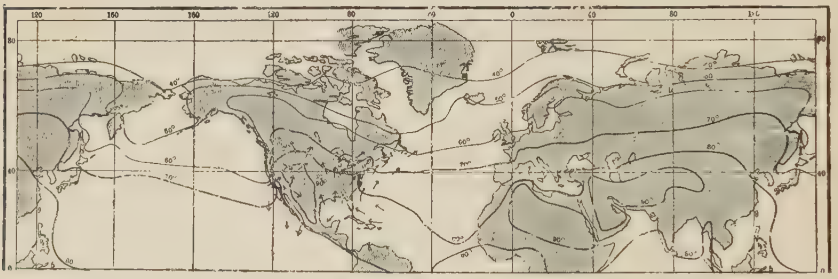

FIG. 2.—JULY.

3—Climatology of the United States by Laurin Blodgett, Philadelphia, 1857.

4—Observations of the N. Y. Board of Regents, Albany, 2 vols.

5—Atmospheric Temperature and Precipitation in the United States, by C. A. Schott, Smithsonian Contributions to Knowledge, Washington, 1876 and 1881.

6—Monthly Reports of the U. S. Signal Service and Weather Bureau, Washington.

7—Monthly Reports of the N. Y. State Weather Bureau, Ithaca.

8—The Climate of New York State, by E. T. Turner, contained in the 5th and 9th Annual Reports of the New York Weather Bureau, Albany.

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* Note.—Fig. 1. The line of 20° passes through N. New York.

Note.—Fig. 2. The line of 70° passes through Central New York.

position and trend of the lines of equal temperature are determined by three factors:

Firstly, the decrease of temperature which occurs as we proceed northward. The average rate of this is 1° F. of annual temperature per degree of latitude.

Secondly, the rapidity of absorption and radiation of heat from land surfaces, as contrasted with the thermal stability of bodies of water. The difference between midsummer and midwinter temperatures in the interior of the American continent and over the Atlantic, at our latitude, is shown approximately as follows:

	MEAN FOR JANUARY.	MEAN FOR JULY.	RANGE OF MO. MEANS.	RANGE OF EXTREMES.
Atlantic..................	50	66	16	27
Interior..................	8	72	64	126

There is also quite as marked difference in the *daily* range of temperature between the land and the ocean.

Thirdly, the transfer of air from region to region, by means of the atmospheric circulation, tends in a marked degree to diffuse and equalize climatic conditions. The most important of these wind systems are as follows:

(*a*) The southwesterly winds which prevail over the temperate zone, in consequence of the heat circulation between high and low latitudes, conjoined with the earth's rotation. These may be called *Planetary Winds.*

(*b*) Winds of the monsoon type, blowing landward in summer and seaward in winter, as the result of unequal thermal conditions of continents and oceans.

(*c*) Winds accompanying those rapidly shifting areas of high and low barometer, known, in their most pronounced form, as cyclonic storms and anticyclones, respectively (see fig. 4, page 106); air flowing *toward* centres of low pressure, and *out from* centres of high pressure. It is important to note, in this connection, that in the northern hemisphere the rotation of the earth tends constantly to deflect air currents toward the right of their direction of motion; hence the circulation about high and low areas is not direct, but spirally inward and outward.

The general westerly circulation (*a*) evidently must tend to bring the moisture and equable temperature of the ocean well inland over the western sides of the continents, as we find to be the case on our Pacific slope and along the northwest coast of Europe; while in a similar manner the conditions of the continental interior will more generally prevail along the eastern coasts. The two cases are fairly presented by the following:

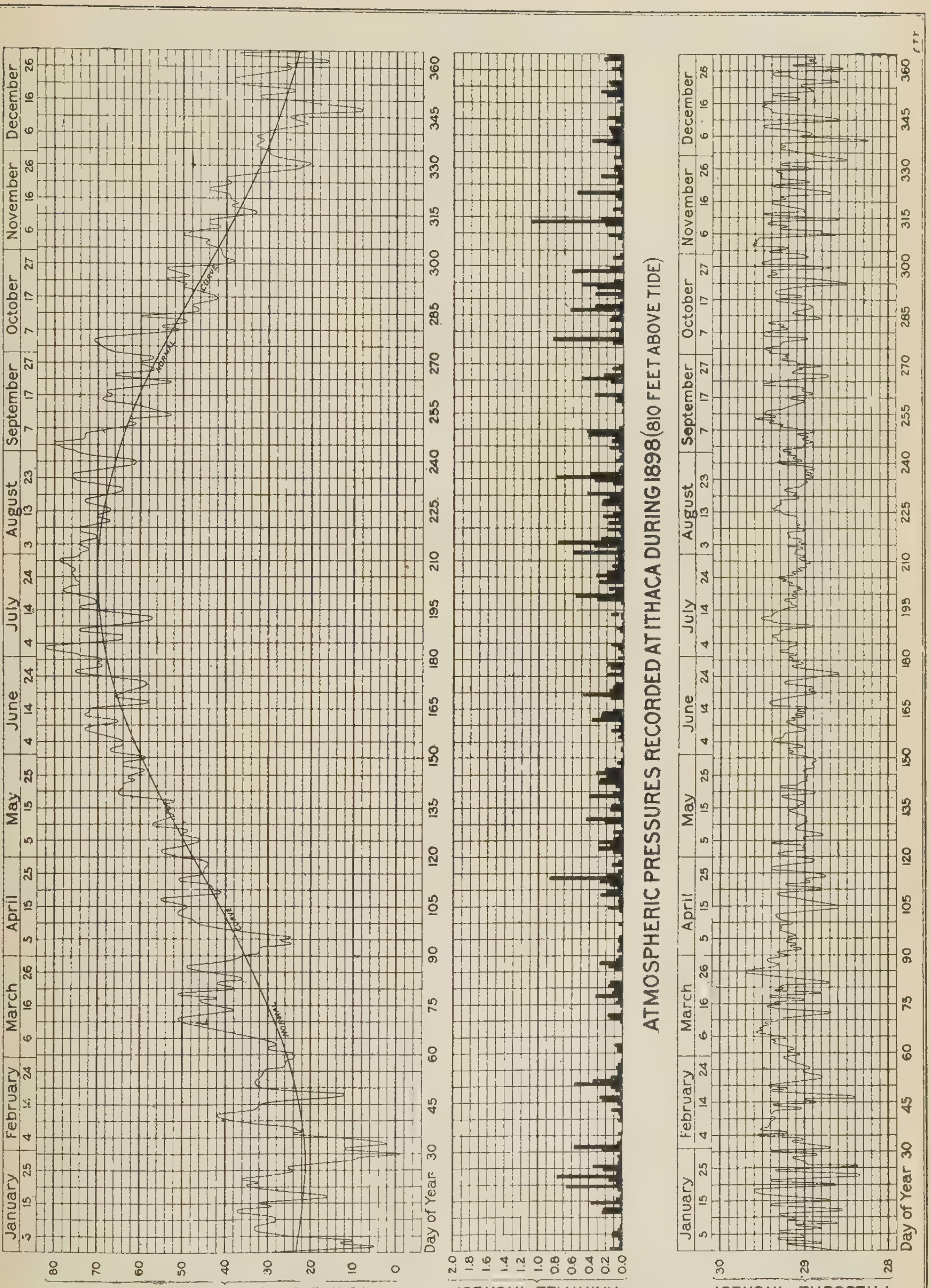
TABLE OF MEAN TEMPERATURES.

		MIDSUMMER.	MIDWINTER.	DIFFERENCE.
West Coast........	San Francisco......	60°	50°	10°
Interior..........	St. Paul..........	72	8	64
East Coast.........	New York City.....	74	31	43
West Coast.......	London, Eng......	64	38	26

The monsoons (class *b*) in winter strengthen the dry, cold winds from the interior eastward toward the ocean, but in summer tend to reverse the east-moving current; hence we must expect the continental type of climate to be much more strongly felt over the eastern States in winter than in summer. It must be noted, however, that the summer monsoon does not reach us directly as a cool sea-wind, since it is not strong enough to overcome the eastward drift until we approach the southern States and Mexican Gulf; but passing inland, over that semi-tropical region, it unites with the general current, and reaches us as the warm and moist southwesterly wind of summer, giving the abundant rainfall characteristic of that season.

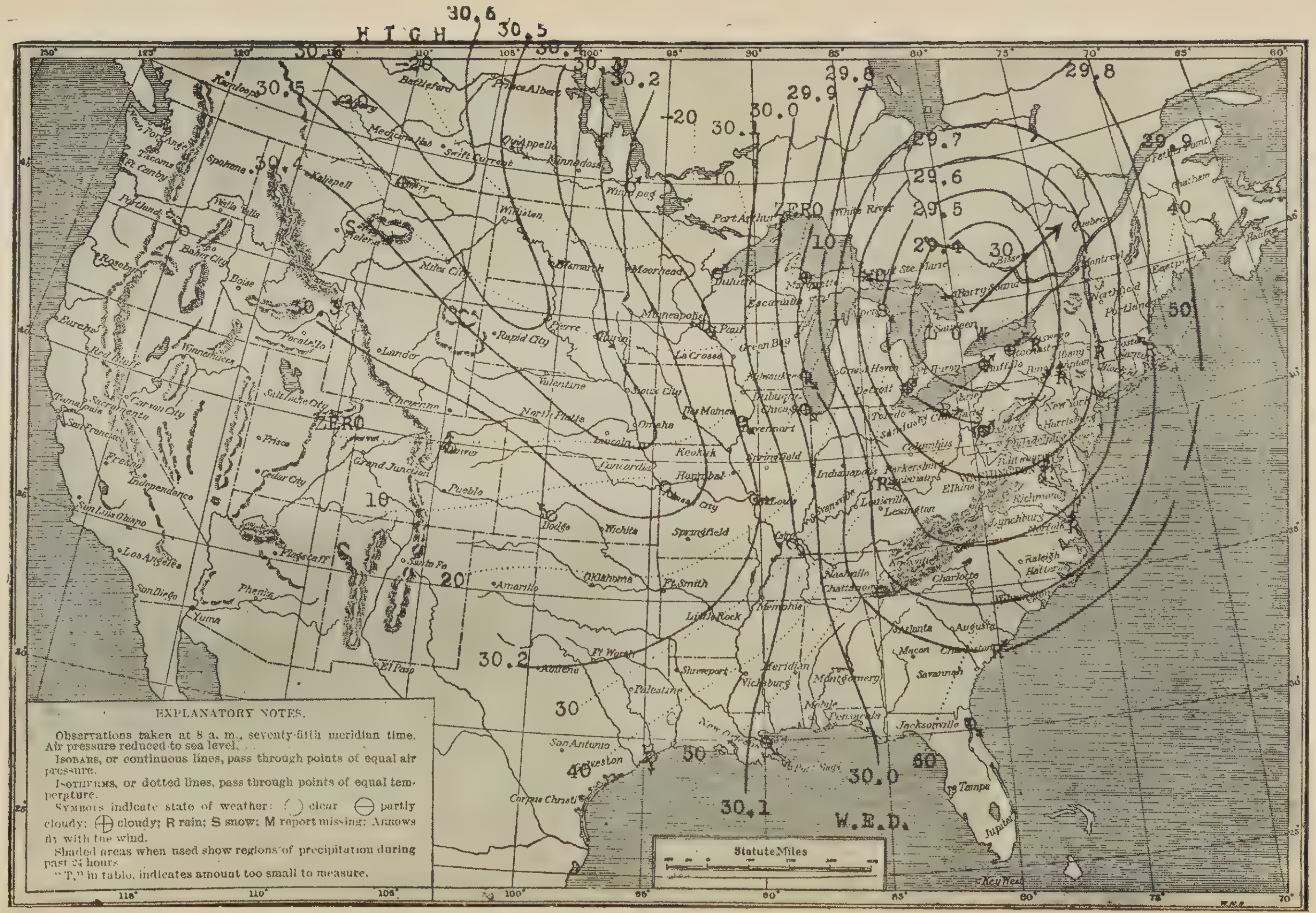
Finally, the temporary winds of class *c* are responsible for the *variability* of weather which is so marked a feature of our climate. The low barometer areas of America move eastward at an average rate of 800 miles per day, and in the large majority of cases pass centrally over the vicinity of the Great Lakes and St. Lawrence valley, drawing in masses of air from the ocean and the south, at the same time giving rain or snow over the northeastern States. These disturbances recur at intervals of three or four days, on an average, in winter, but with less frequency and strength in summer. They are generally followed by high-pressure systems from the interior, whose outflowing winds are characteristically dry and cold; so that, in fact, our winter climate is made up of constant alternations of maritime and continental conditions.

Figure 3 shows graphically the fluctuations of temperature and weather to which New York is subject, and their close relation to



ATMOSPHERIC PRESSURES RECORDED AT ITHACA DURING 1898 (810 FEET ABOVE TIDE)

FIG. 3.



EXPLANATORY NOTES.

Observations taken at 8 a. m., seventy-fifth meridian time. Air pressure reduced to sea level.

Isobars, or continuous lines, pass through points of equal air pressure.

Isotherms, or dotted lines, pass through points of equal temperature.

Symbols indicate state of weather: ◯ clear ⊖ partly cloudy; ⊕ cloudy; R rain; S snow; M report missing; Arrows fly with the wind.

Shaded areas when used show regions of precipitation during past 24 hours.

"T," in table, indicates amount too small to measure.

the passage of high and low barometer areas near the State. (It should be noted that the temperatures indicated by the wave-line are the daily averages for the entire State, and not the local extremes of heat and cold.)

The conditions attending a cyclonic storm and the succeeding anti-cyclone are shown by the accompanying weather-map (Fig. 4) for 8 A.M., February 13th, 1900. The tracings of the self-recording barometer and thermometer at Ithaca on the same date are reproduced in Fig. 5, together with the wind direction. It will be seen that the approach of the storm, indicated by a falling barometer, gave southerly winds and rising temperature until 2 P.M., when the storm centre passed nearest the station. The wind then immediately shifted to the westward, increasing in force, and at the same time the temperature fell, at first very suddenly, and then gradually, until the crest of the "high" passed on the following day.

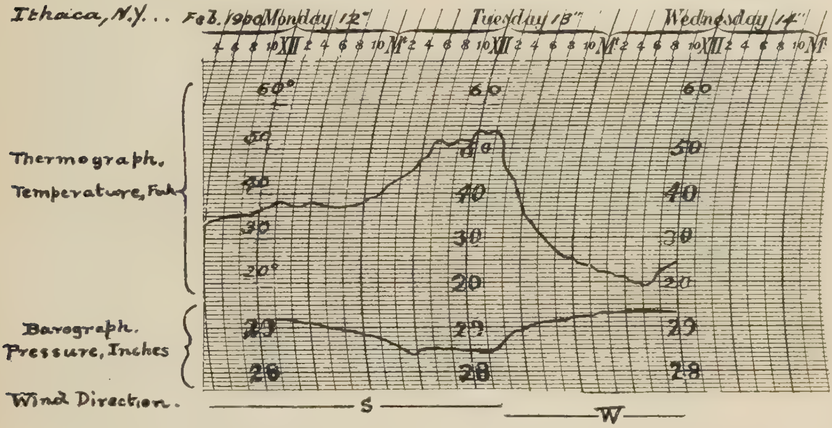
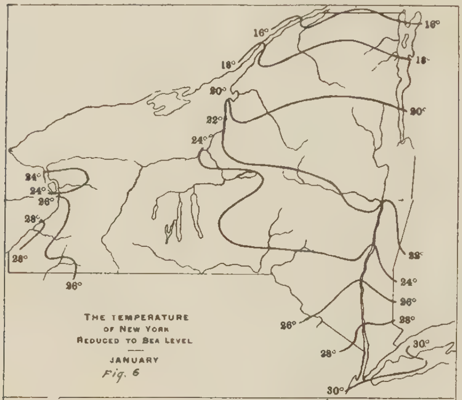


Fig. 5. Temperature Pressure and Wind Direction at Ithaca. Feb 12th to 14th

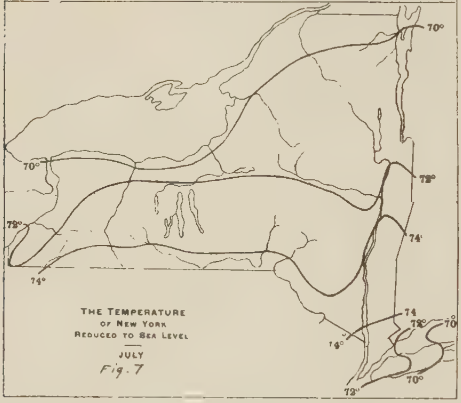
The element technically known as *variability* of temperature, *i. e.*, the average difference from day to day, amounts to over 10° in Maine and Quebec, for the month of January, when the maximum value is reached. The mean value for New York State is 8°; over the south Atlantic and Gulf coasts, 6°; on the coast of California, 2°.

In the immediate vicinity of our coast, the greater part of the annual precipitation occurs in winter, when the low areas are most frequent and intense; but in the interior of the State, heavy local rains during the period of the summer monsoon bring the maximum fall of the year at that season.

Influence of Great Lakes.—We have thus far omitted to mention the important modifications of our climate due to the Great Lakes. These bodies of water follow the seasonal temperature changes much more closely than does the ocean, owing to their smaller mass; but nevertheless such scanty data as have been gathered indicate that the surface of Lake Ontario averages from 10° to 15° warmer in winter, and cooler in summer, than the adjacent land areas; hence the northwesterly winds of winter, in passing over the lake, are raised to a temperature considerably higher than obtains on the north shore. This influence is felt throughout the portions of the State lying to the south and east of the lakes, although decreasing rapidly as we proceed inland. In northern New York, on the other hand, the coldest winds of winter are not affected by the lakes, and in consequence the winters are much more severe than could be expected as a result of the higher latitude of the region alone. The southerly winds which predominate during the warmer portion of the year, of course, reach this State uninfluenced by the lakes, hence the temperature conditions are much more uniform over our entire area than in winter. The tempering effect of the lakes and ocean is clearly brought out by the accompanying isothermal charts, from which other sources of variation have been largely eliminated by reduction of temperatures to sea-level.



THE TEMPERATURE
OF NEW YORK
REDUCED TO SEA LEVEL
JANUARY
Fig. 6



THE TEMPERATURE
OF NEW YORK
REDUCED TO SEA LEVEL
JULY
Fig. 7

LOCAL CLIMATE.

Topographical Features.—The main portion of New York State is a broken and irregular plateau, whose average elevation is 1,200 to 1,500 feet above tide. This plateau is bordered on the west and northwest by considerable tracts of level lowland along the shores of the Great Lakes and the St. Lawrence River; while near the eastern border the valleys of the Hudson River and Lake Champlain form a deep channel extending from the seaboard directly northward into Canada.

Along the western side of this depression the highlands reach their greatest elevation in the mountain systems of the Adirondacks, Catskill, and several minor ridges; while on the east also the valley is closed in by the high hills of New England. The Hudson Valley is united to the lowlands of the Great Lakes by the narrow valley of the Mohawk, which divides the central plateau from that of the northern or Adirondack region. Among the more important minor depressions are the valleys of the Central Lakes and those of the Delaware and Susquehanna Rivers and their tributaries.

Elevations and depressions of land surface affect temperature conditions in three important ways:

Firstly, the temperature average for the day (24 hours) decreases with elevation at the rate of about 0.3° and 0.4° per hundred feet in winter and summer, respectively. This rule should give to the plateaux a temperature 4° to 6° lower than that at sea-level.

Secondly, the highlands act as a shelter or windbrake for the neighboring valleys; and this effect becomes very important in a territory so irregular as that of New York. The temperate climates of the various "fruit belts" of the State are due both to a sheltered situation and to the proximity of bodies of water.

Thirdly, a flow of cold dense air from the hill slopes to the valley bottoms occurs on clear, still nights, and frequently so much reduces the temperature of the lowlands as to cause severe frosts, which are escaped at higher levels; and, since the highest midday temperature also occurs in the valleys, their daily range is often excessive. The following example of the conditions in Central New York during a cold wave will sufficiently illustrate this point:

TEMPERATURE (FAHRENHEIT).

LOCATION.	Altitude.	JANUARY 9.			JANUARY 10.			JANUARY 20.			JANUARY 21.			FEBRUARY 6.		
		Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.
	Feet															
Oxford (Hill).........	1250	21	4	17	17	—8	25	11	—24	35	21	—10	31	22	—3	25
Brookfield (Val.)......	1350	24	—3	27	17	—16	33	6	—28	34	21	—17	38	30	—16	46

NOTE.—The rapid rise of the general surface of the eastern plateau brings the valley bottom at Brookfield above the level of Oxford. The distance between the stations is about thirty miles.

The different thermal conditions at hill and valley stations are also shown by tracings of thermographs in Fig. 8.

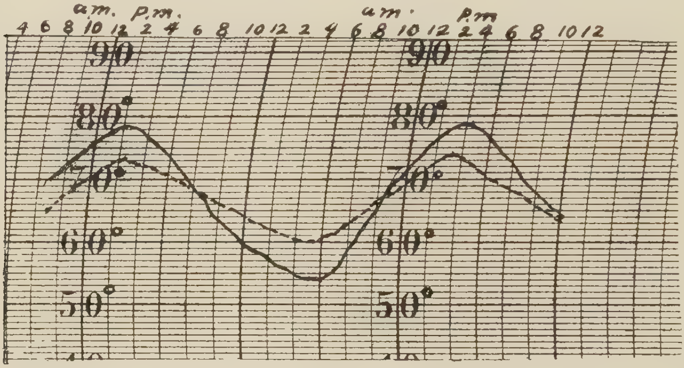


Fig 8 Temperature curves at Mountain and Valley stations of New York Aug 21st and 22st. 1891

---Temp. at Minnewaska Elevation 1800 ft

— . " " Port Jervis 470 "

The nocturnal valley-winds are an important climatic factor, since they bring a cool and refreshing air at night which is not felt on the plains or upper hill slopes. A special study of the subject has been made at Ithaca, in the Cayuga Lake valley, where it is found that the breeze usually arises from one to two hours after sunset, blowing from the south down the channels of the two principal streams flowing into Cayuga Lake, and gradually gaining a velocity of 10 or 12 miles per hour as the night advances. Small balloons set adrift at night were often observed to drift northward with this surface current until an altitude of 200 or 300 feet had been reached, when they were caught by the prevailing wind, and abruptly changed their course to the eastward.

We are now prepared to consider in more detail the temperature conditions of the State, as exhibited by the accompanying tables and charts (Figs. 9, 10 and 11).

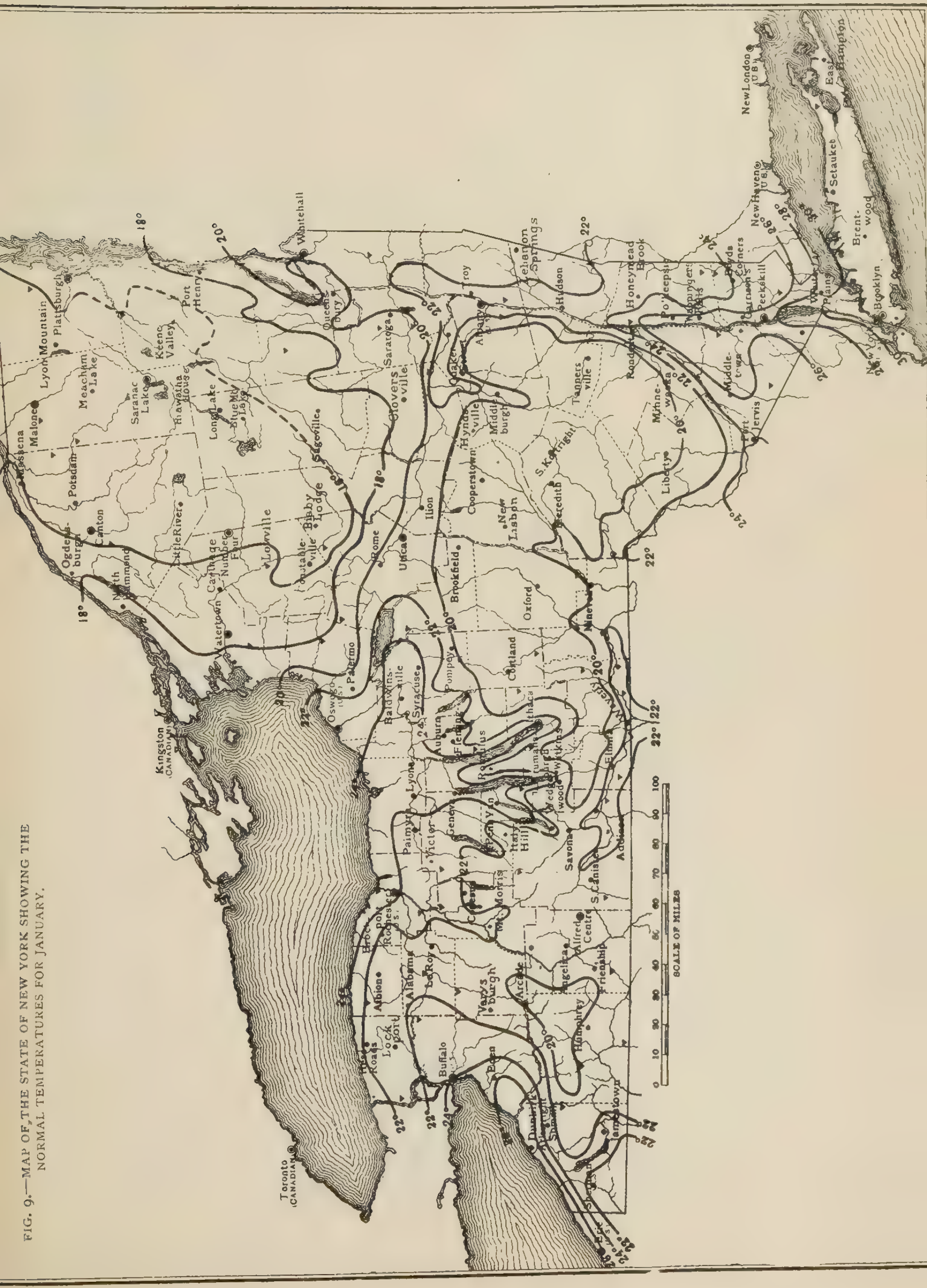


FIG. 9.—MAP OF THE STATE OF NEW YORK SHOWING THE NORMAL TEMPERATURES FOR JANUARY.

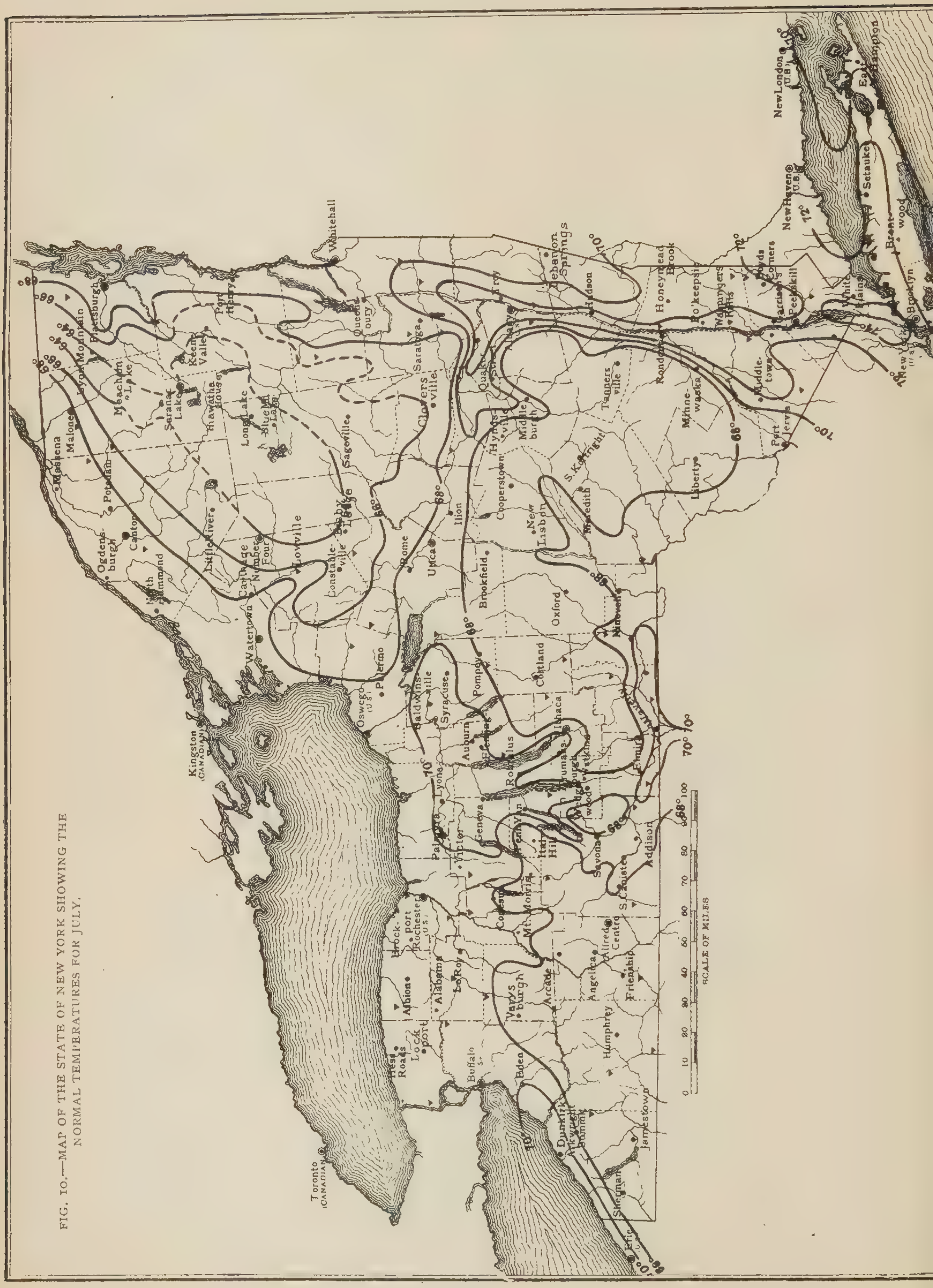


FIG. 10.—MAP OF THE STATE OF NEW YORK SHOWING THE NORMAL TEMPERATURES FOR JULY.

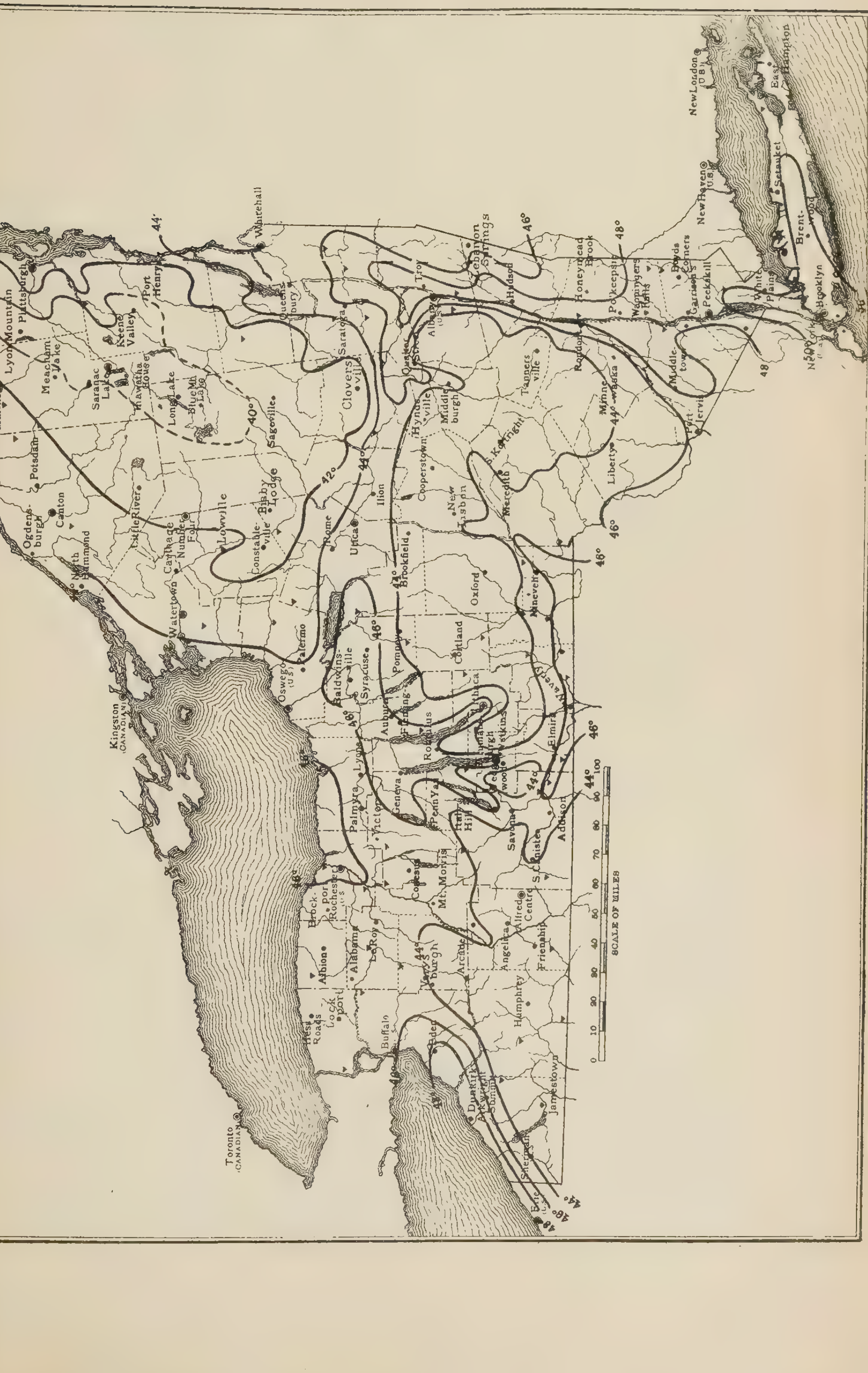


FIG. 11.—MAP OF THE STATE OF NEW YORK SHOWING THE NORMAL TEMPERATURES FOR THE YEAR.

TABLE I.—MONTHLY AND ANNUAL TEMPERATURE AVERAGES, DERIVED FROM RECORDS OF TEN YEARS OR MORE.

REGION AND STATION.	MEAN TEMPERATURE (FAHR.).												
	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
ATLANTIC COAST:													
Setauket, L. I.	31	30	36	47	58	67	72	71	65	54	44	36	51.0
New York City	30	31	37	48	60	69	74	72	66	55	44	34	51.7
CENTRAL PLATEAU:													
Cooperstown.	20	21	28	41	54	64	68	65	57	46	35	25	43.9
Angelica	22	22	30	43	55	65	68	64	58	46	36	26	44.6
NORTH'N NEW YORK:													
Number Four	17	17	25	39	52	61	64	62	56	44	32	22	41.0
Plattsburg	16	17	26	41	55	65	70	68	58	47	34	22	43.2
GREAT LAKES:													
Buffalo	25	25	31	42	54	65	70	69	62	51	39	30	46.8
Rochester	24	25	31	44	57	66	71	69	62	50	39	30	47.4
HUDSON VALLEY:													
Albany	23	24	32	46	59	69	72	71	63	51	39	29	48.3
ENTIRE STATE:													
(50 stations)	22	23	29	42	56	65	69	67	60	48	36	26	45.4

TABLE II.—EXTREMES OF TEMPERATURE FOR THE YEAR. FROM RECORDS OF THE PAST TEN YEARS.

REGION AND STATION.	ELEVATION.	MINIMUM.			MAXIMUM.		
		Average for entire period.	Lowest during entire period.	Highest Min. during period.	Average for entire period.	Highest during entire period.	Lowest Max. during period.
COAST:							
Setauket	40	+ 4	− 5	+12	95	98	88
New York City	300	+ 2	− 6	+10	95	99	91
HUDSON VALLEY:							
Albany	97	− 9	−16	− 4	96	100	94
CENTRAL PLATEAU:							
New Lisbon	1234	−19	−26	−13	92	94	87
Angelica	1340	−20	−27	−10	92	95	88
NORTHERN NEW YORK:							
Number Four	1571	−25	−31	−17	88	91	85
Canton Potsdam	300 300	−27	−43	−15	94	98	90
Plattsburg	180	−18	−25	−12	94	96	90
GREAT LAKES:							
Buffalo	770	− 3	−13	+ 7	90	95	84
Rochester	520	− 4	−10	+ 6	95	99	92

The Atlantic Coast Region.—The nearest approach to a maritime climate to be found within the territory of New York is that of Long Island. The values given for Setauket, in table 1, indicate a midwinter temperature nearly as high as that for Philadelphia, and 9° above the average for the State; while the midsummer temperature is but 3° above that average. The effect of the ocean and Sound in moderating the *daily* ranges, and especially the winter minima, is even more marked, so that the region is extremely well adapted to the raising and early marketing of tender fruits and vegetables. The first killing frost occurs, near the coast, about the beginning of November, and the last about the middle of April, on an average. Usually, during the winter, the ground is covered with snow for brief periods only.

The *sea breeze* is the most characteristic and important feature of maritime climate in summer. In fair weather the land-wind, which is usually felt at night, ceases soon after sunrise, and the temperature rises rapidly until 9 or 10 o'clock, when the cool breeze from the ocean sets in, gaining strength until early afternoon, when a velocity of 10 or 15 miles per hour may be attained. In general the breeze penetrates inland about ten miles, but on southern Long Island its force and penetration are greatly augmented by the prevailing southerly wind of summer. The accompanying diagram, exhibiting typical hot-weather temperature curves for an inland and coast station, brings out very clearly the moderation of midday heat due to the sea breeze. (Fig. 12.)

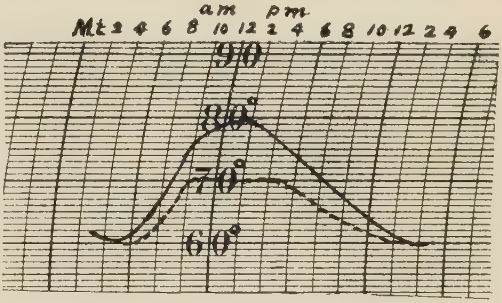


Fig. 12 Temperature as affected By Sea-Breeze.
— Inland Station
---- Sea Coast Station

The *Central Plateau*, extending from the Great Lake region on the west to the Hudson Valley on the east, has a more uniform temperature than might be expected to obtain over so large an area, since the general rise of the surface toward the south and east largely counterbalances the thermal effects resulting from proximity to the ocean and a more southerly latitude. Hence, we may consider the higher levels of this region to be fairly represented by the averages given in the table for Angelica and Cooperstown. The temperature of this section is usually sufficiently low to maintain a continuous covering of ice and snow throughout the winter; but the larger valleys are subject to frequent thaws, which may leave the ground bare for considerable periods. Only hardy fruits can thrive on the highlands, and even in the valleys the temperature commonly falls low enough to damage, or even kill, peaches.

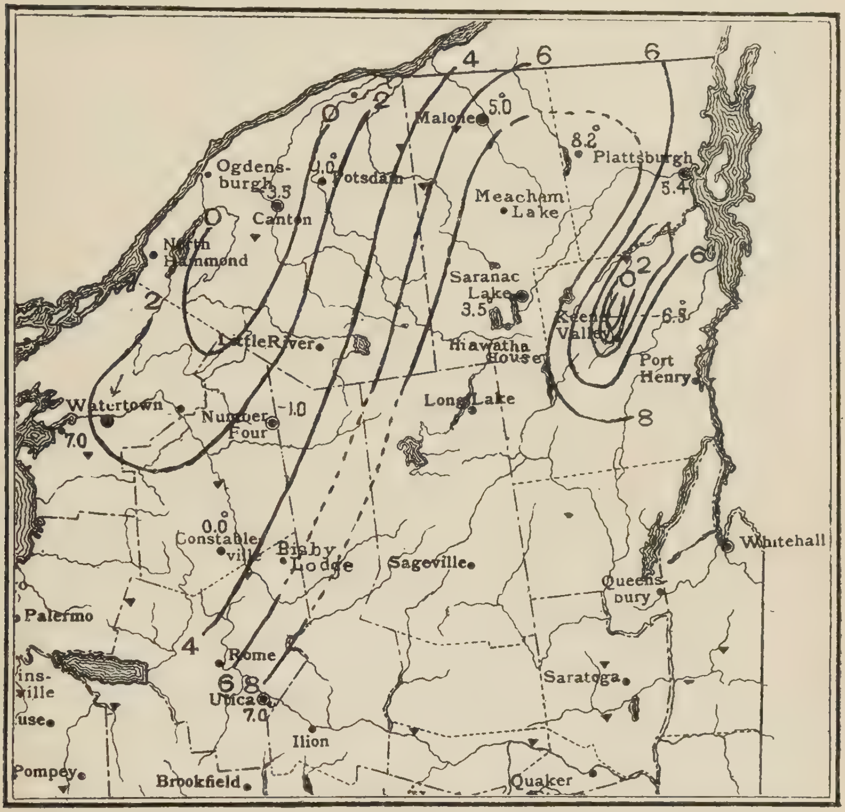
The midsummer maxima over the plateau average about 4° lower than on the lowlands, and at the summits of the higher hills and mountains the midday heat is, of course, still more moderate. (See fig. 8, p. 110.)

The average duration of ice in Otsego and Cazenovia lakes (altitude about 1,200 feet) is from December 15th to April 15th. The first killing frost is likely to occur as early as October 1st, and the last in May.

Northern New York has a *winter* climate almost as severe as that of the northern interior States, while the summer heat is nearly as great as at equal altitudes in southern New York; and since the region is largely exempt from maritime influences, it is especially liable to sudden and very abrupt changes of temperature. The lakes and forest tracts of the Adirondack mountains have usually a heavy covering of firm snow and ice from the latter part of November until the close of April, so that the air is much dryer during that period than in warmer portions of the State. To this fact, together with the presence of large areas of pine woodland, is probably due the favorable effect of the Adirondack climate upon lung diseases; an effect, however, which is shared by the higher regions of southeastern New York.

The minimum temperatures recorded in the St. Lawrence Valley are as low as those of the Adirondack region; in fact, the lowest temperature on record for this State (−46°) was observed at the border of the St. Lawrence Valley. There, as in all regions of contiguous mountain and lowland tracts, we may often observe that the temperature actually *increases* with altitude during the progress of a cold wave. This phenomenon, known as *inversion of temperature*, indicates that the cold which accompanies cloudless areas of high barometer is largely a surface phenomenon, due to loss of heat from the earth by radiation. The diagram given herewith shows a typical case of inversion, derived from the records of the State Weather Bureau. Had the temperature decreased with altitude, at the usual rate, a reduction of the values to sea-level would have given a uniform temperature for the entire region; whereas in this case the isotherm of 0° is found at the lowest levels, and that of 8° in the highest portion of the Adirondacks.

FIG. 13.—INVERSION OF TEMPERATURE IN NORTHERN NEW YORK, DECEMBER 8TH, 1890.



ISOTHERMAL LINES SHOW THE MEAN DAILY TEMPERATURE AS REDUCED TO SEA LEVEL BY DEDUCTING 0.3° FROM THE ACTUAL TEMPERATURE FOR EACH 100 FEET OF ELEVATION. SMALL FIGURES SHOW ACTUAL TEMPERATURES. [THE MEAN TEMPERATURE AT KEENE VALLEY WAS—6.5°.]

Navigation on the St. Lawrence River is closed by ice, on the average, from about the middle of December until early in April.

The Champlain and Hudson valleys owe their high summer temperature to a sheltered position, as well as to the predominance of southerly winds throughout their extent at that season. The northerly winds of winter, on the other hand, have a clear sweep as far south as the high ridges of the lower Hudson Valley, so that the temperature is often nearly as low as upon the adjacent highlands. The advance of spring, however, is comparatively rapid, especially to the southward of the Mohawk Valley; hence this region is well adapted to the growing of early vegetables and small fruits.

The broadest portion of Lake Champlain is commonly frozen over from January to early April. Navigation closes on the Hudson, at Albany, on December 16th, and opens on March 20th, for the average year.

The Lake Region.—Inspection of table I and Figs. 6 and 7 shows that the tempering effect of the Great Lakes is most marked in winter, when the prevailing winds must pass over their surface before reaching New York. This effect is clearly brought out by comparing the temperature recorded on the north and south sides of the lakes during the prevalence of a cold wave.

DATE.*	NORTH SHORE.		SOUTH SHORE.	
	KINGSTON.	TORONTO.	OSWEGO.	ROCHESTER.
January 19, 8 A.M.	+ 2	+4	+12	+16
January 19, 8 P.M.	− 6	0	+ 8	+12
January 20, 8 A.M.	−22	−8	− 2	+ 6

* The winds were northerly throughout the observations.

Here Lake Ontario appears to have maintained the temperature at Rochester, from 14° to 28° above the point to which it would otherwise have fallen. The frequent occurrence of conditions similar to the above gives to the southern shore of Lake Ontario an average mid-winter temperature 5° higher than that of the northern shore. It thus becomes possible, in our lake district, to raise peaches, grapes and the tender vegetation which can scarcely exist in the adjacent portions of Canada, nor even in the southern interior of the State. The noted grape belt of Chautauqua County, in which over 30,000 acres of that fruit are under cultivation, owes its mild climate both to the proximity of Lake Erie and to the high hills which rise on the eastern side in a semi-oval form. Killing frosts rarely occur in this locality before the close of October; and their latest date in spring is usually previous to May 10th.

The eastern portion of Lake Erie is commonly frozen over during a portion of the winter, navigation being closed at Buffalo from early in December to April. Lake Ontario, owing to its greater depth, is less obstructed by ice, and at Oswego the period of navigation is two or three weeks longer than at Buffalo.

A small daily range of temperature obtains at Lake Stations in winter, owing to the almost constant cloudiness of the region as well as to the tempering effect of the water.

The thermal conditions of the Cayuga and Seneca Lake valleys are so similar to those of the Great Lakes that no special treatment of them is necessary. Cayuga Lake is seldom, and Seneca Lake never, frozen over completely. Their immediate shores have an equable temperature, which, with the shelter afforded by the surrounding hills, renders this region a favorable one for fruit culture.

PRECIPITATION.

The amounts of annual precipitation in different sections of the State are mainly determined: first, by proximity to various sources of vapor or vapor-laden air-currents; and, secondly, by the character of local topography. In the case of New York State, we may say that, under similar conditions, the precipitation is roughly proportional to the altitude of land-surfaces. This rule does not apply to the central and southern Atlantic States, whose mountain ridges are parallel to the prevailing direction of vapor-bearing winds.

As has been stated, the Atlantic Ocean furnishes the principal vapor supply of the northeastern States. While passing inland with easterly winds the moisture is, in the first place, largely precipitated over the mountains of New England, as is rendered apparent by the extraordinary rainfall on Mount Washington, averaging over 90 inches per annum. A similar condition no doubt exists through the Green Mountain system near the New York border; and hence the lowlands to the westward, including the Champlain and upper Hudson valleys, receive a somewhat deficient supply as compared with that of the State as a whole. A marked increase of rainfall is again found in the Adirondack highlands, and beyond these a decrease in the St. Lawrence valley.

Sea-winds from the southeast find no obstruction on the immediate coast of New York; but passing inland they meet the abrupt hill ranges of the southeastern counties, and give to each a copious rainfall as compared with that of the intervening valleys. Liberty, in the mountainous region of Sullivan County, also shows the direct influence of the sea-wind both by its large annual precipitation and by a pronounced secondary maximum in winter—a feature not noticed at stations further northward.

Western New York receives an appreciable portion of its vapor supply from the Gulf of Mexico, judging from the frequent southwesterly direction of the rain-winds, and also from similarities existing between the rain types of the Lower Lakes and those of the Gulf and the Mississippi and Ohio valleys. The total precipitation over the depressed area occupied by the Lakes is rather below

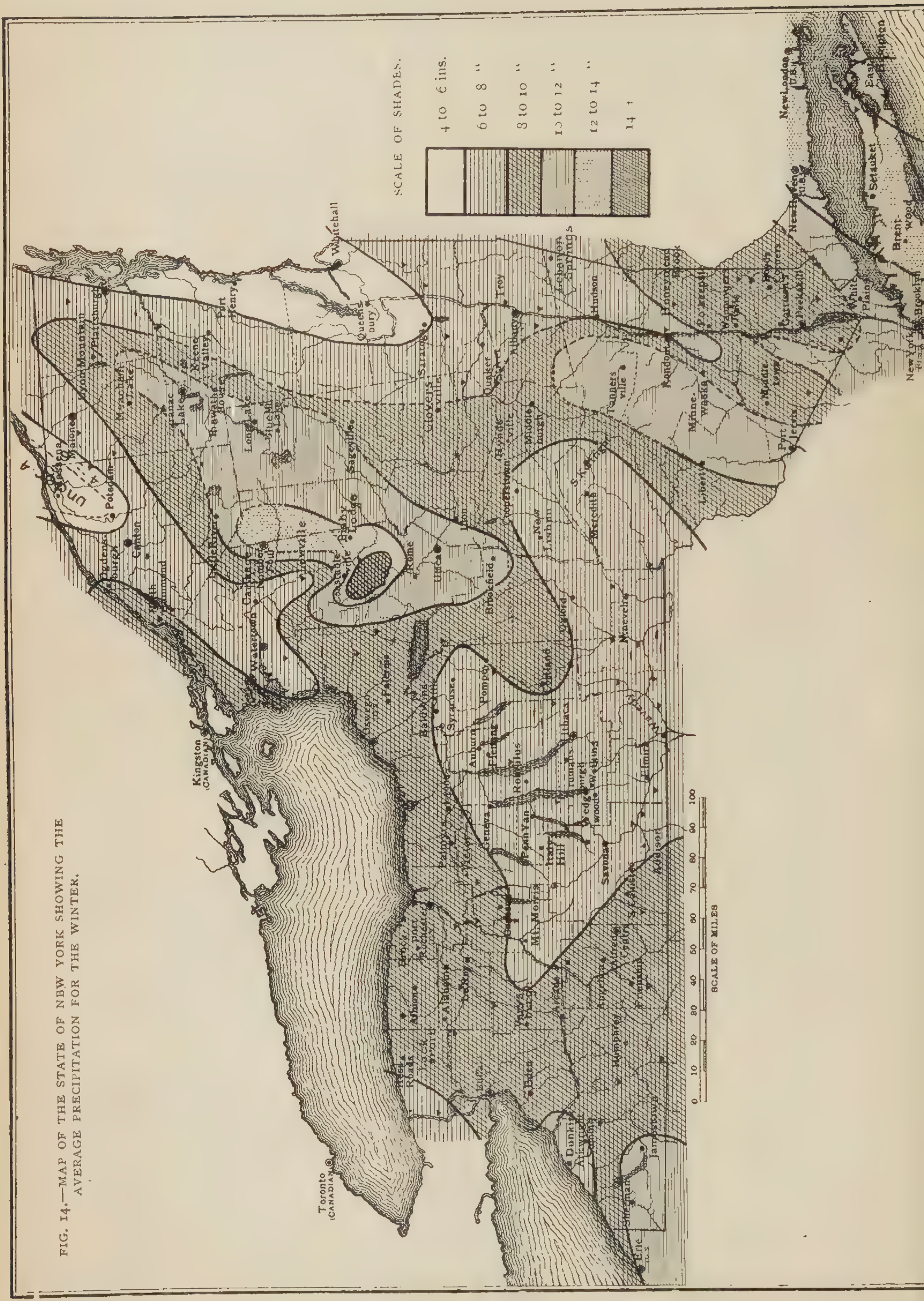


FIG. 14.—MAP OF THE STATE OF NEW YORK SHOWING THE AVERAGE PRECIPITATION FOR THE WINTER.

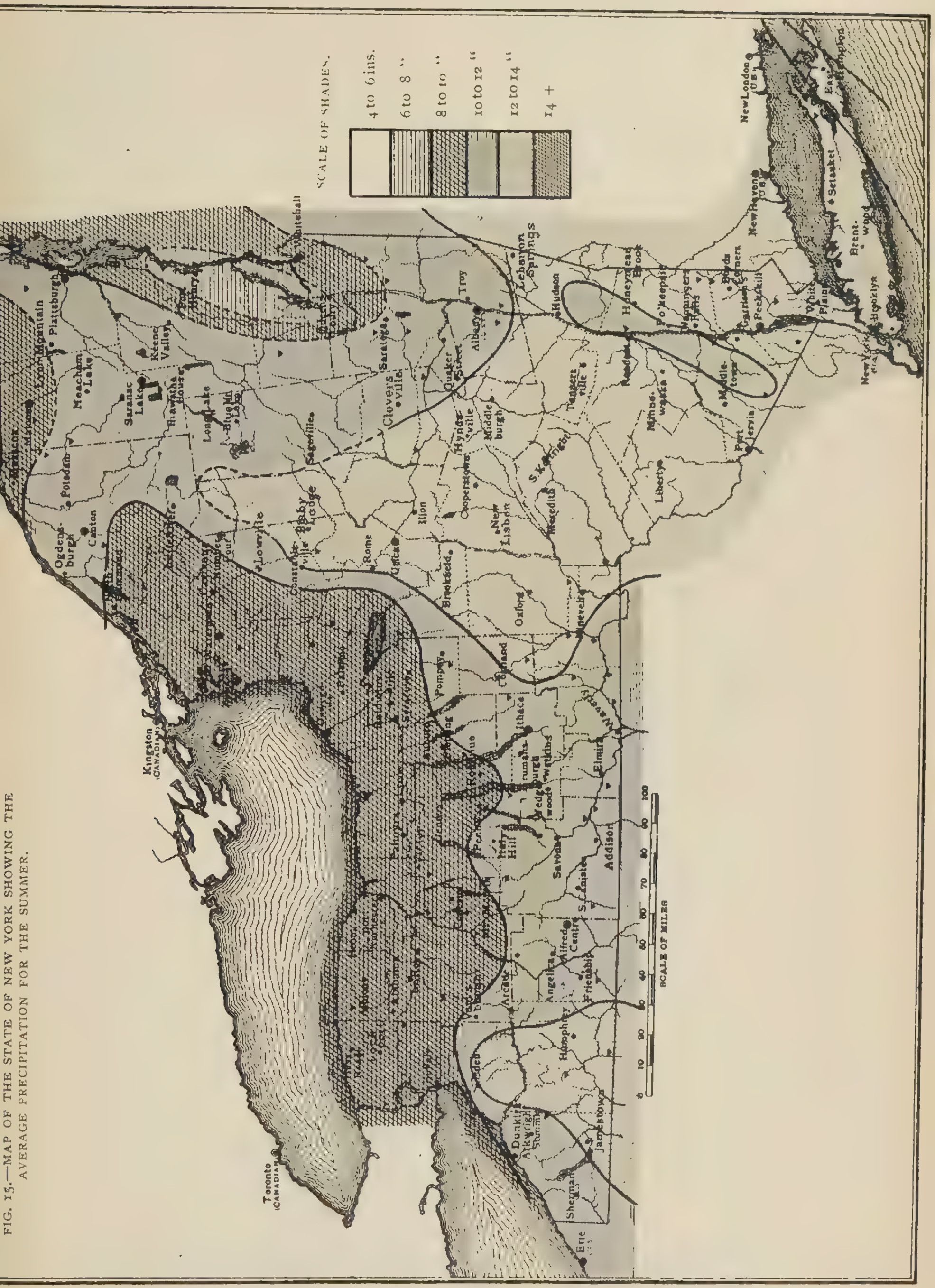


FIG. 15.—MAP OF THE STATE OF NEW YORK SHOWING THE AVERAGE PRECIPITATION FOR THE SUMMER.

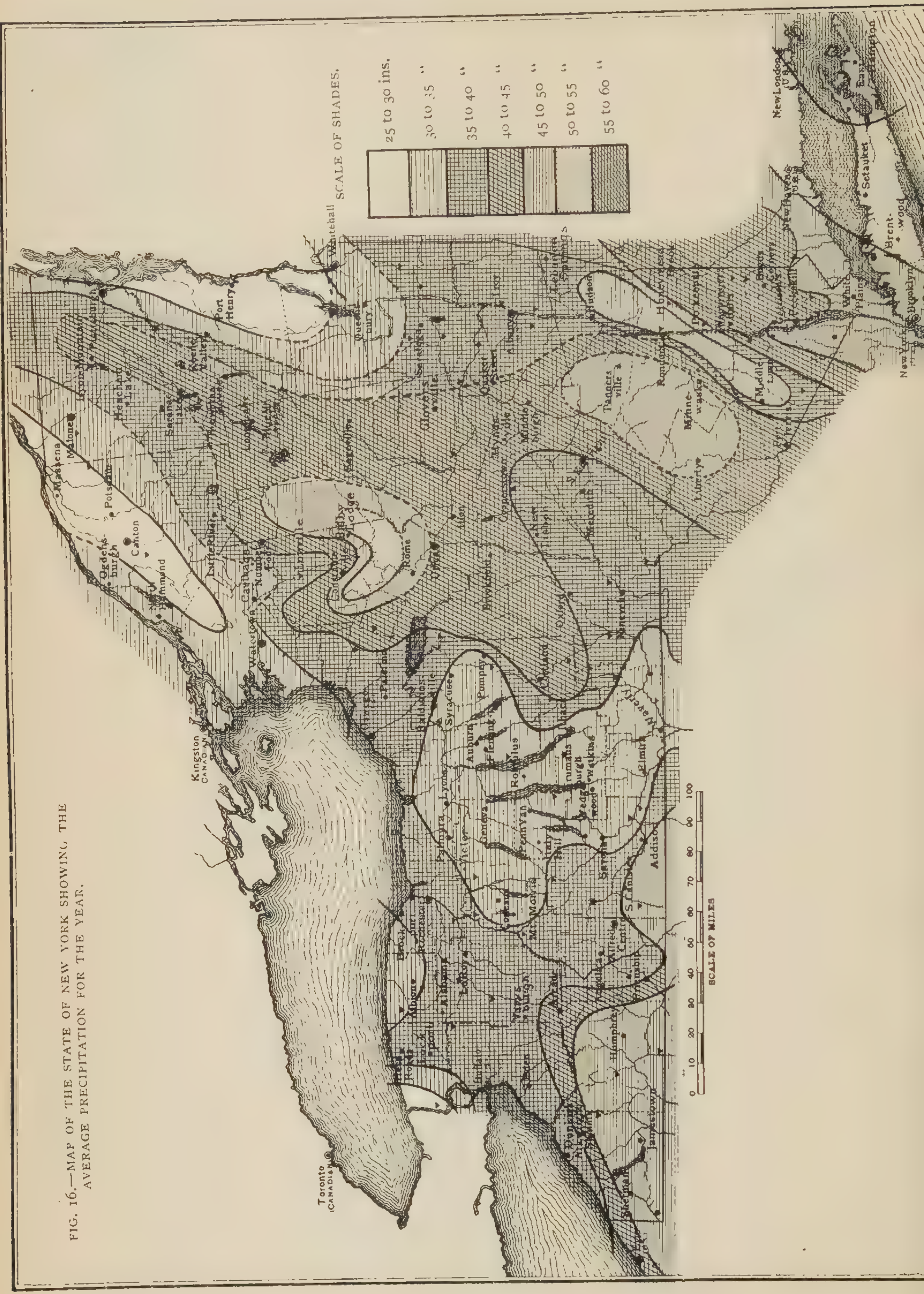


FIG. 16.—MAP OF THE STATE OF NEW YORK SHOWING THE AVERAGE PRECIPITATION FOR THE YEAR.

the average for the State; but, wherever the surface rises abruptly from their shores, the amount rapidly increases and considerably exceeds that common to equal altitudes in the interior. The winter maximum appears prominently in a large snowfall over the southwestern highlands, and still more so through a section including the hills of Lewis County, the upper Mohawk valley and an adjacent spur of the eastern highlands in Madison County.

The rainfall in central New York is generally abundant, although somewhat less than that of the southeastern and southwestern highlands. A deficiency, as compared with the average for the State, exists in the principal valleys of the Susquehanna system and also in the depression of the Central Lakes.

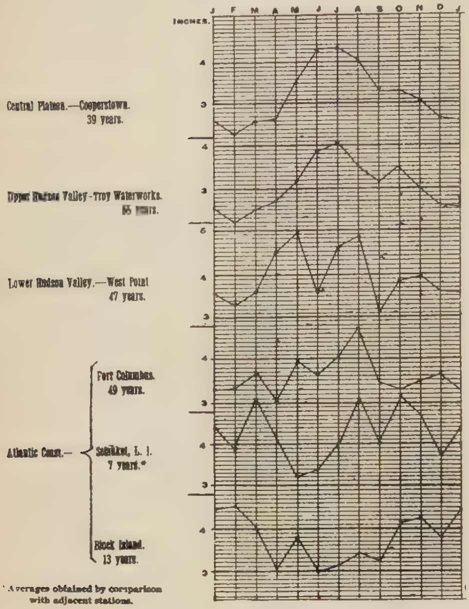
Records have not been kept long enough to establish, with accuracy, the amount of rainfall in the central Adirondack region. The brief series of observations obtainable from points near the eastern and western limits of the plateau have been carefully analyzed by comparison of individual monthly values with those of the adjacent stations in the Champlain and St. Lawrence valleys, the highlands showing a marked excess in all cases. The amounts of rain in the interior, shown by the accompanying charts, were estimated from the data of border stations, somewhat modified by the character of local topography.

MONTHLY AND SEASONAL FLUCTUATIONS OF RAINFALL.—The fluctuations in the average or normal amount of rainfall from month to month do not occur in a uniform manner over the entire area of New York, but must rather be classed under several quite distinct types, depending upon atmospheric conditions, which have already been summarily described. The character of various types and their important modifications are shown in considerable detail by Figures 17, 18 and 19.

A close approach to the continental type of rainfall, with its early summer maximum, is found over the central plateau regions (including the eastern and western plateaux and the southern Adirondack region), as represented by Cooperstown. Proceeding eastward to the central Hudson valley, a July maximum is found which extends through the Champlain valley and over the Province of Quebec. In the southern Hudson valley the maximum varies from July to August, while south of the highlands the maximum occurs in August. This condition also extends over Long Island to Setauket, but disappears at East Hampton and Block Island. The Great Lakes and St. Lawrence Valley show a June or July maximum, which, however, is secondary to that of autumn.

FIG. 17.

FLUCTUATIONS OF NORMAL RAINFALL.



* Averages obtained by comparison with adjacent stations.

FIG. 18.

FLUCTUATIONS OF NORMAL RAINFALL.

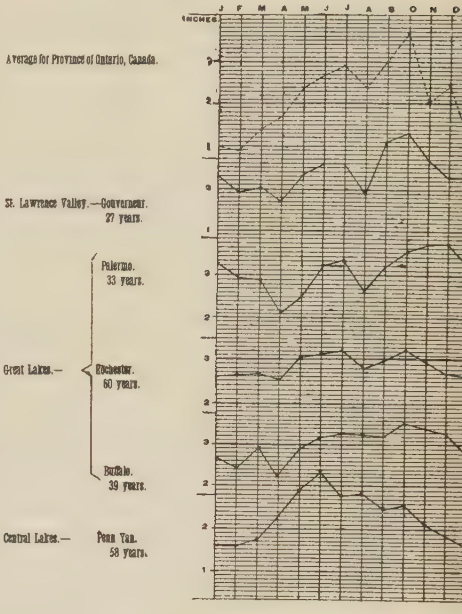
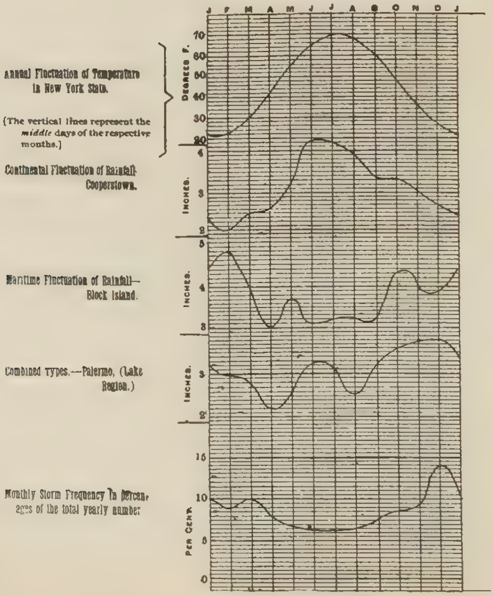


FIG. 19.

RELATION OF RAINFALL TO STORM FREQUENCY AND TEMPERATURE.



(The vertical lines represent the *middle* days of the respective months.)

Autumn Rains.—Over the State, generally, a large precipitation obtains in October, as compared with the months immediately preceding and following. This constitutes the principal maximum of the year at several stations of the St. Lawrence Valley, the central part of the Great Lake Region, Central Long Island, and beyond the limits of New York, in New Brunswick, Nova Scotia, and Ontario. Within this State an October *minimum* is found only in the vicinity of New York city; but it is a feature common to the coast south of that point, and also obtains at several places in the interior of New England. A relatively light rainfall during September is characteristic of the State at large; whereas in the Upper Lake region the general autumn maximum occurs during that month. Erie, Pa., shows a November maximum, which feature also prevails in the Ohio Valley.

Over the greater part of the interior of New York the precipitation during the winter is the least of the year. Eastern Long Island, on the contrary, has its annual maximum at that season; while the coast stations generally appear to be about equally subject to continental and maritime influences, showing but slight seasonal variations. This is also true, in even a greater degree, of the region bordering the Lower Lakes, and Rochester may be taken as an example in which an annual fluctuation is almost wholly lacking. Oswego has a principal maximum in June, and a secondary in autumn and early winter; but the latter becomes predominant at Palermo, a few miles to the eastward, and attains a remarkable intensity along the ridge running parallel to the lake in Lewis County.

In the *spring*, a March maximum is very pronounced at the Atlantic coast stations, and is also observable inland in a lesser degree. A diminution again occurs in April, after which the curves of the continental type rise towards their summer maximum, corresponding to the change of prevailing winds from northerly to southerly which occurs in May.

Local Thunderstorms occur almost daily in some portions of the State during the summer months. They form most frequently over the high hills of southern and eastern New York, thence drifting in a general easterly direction, at a rate of about 30 miles per hour, often as far as the coast or over New England. Regions showing a pronounced summer maximum of rainfall, as a rule, owe this feature to frequent thunderstorms.

Figure 20 indicates the regions in which local thunderstorms most frequently originate, and the directions in which they are most likely to move and spread out. Figure 21 shows the progress of a thunderstorm of a more general character, advancing in front of a large high-pressure area, and preceding a change of weather.

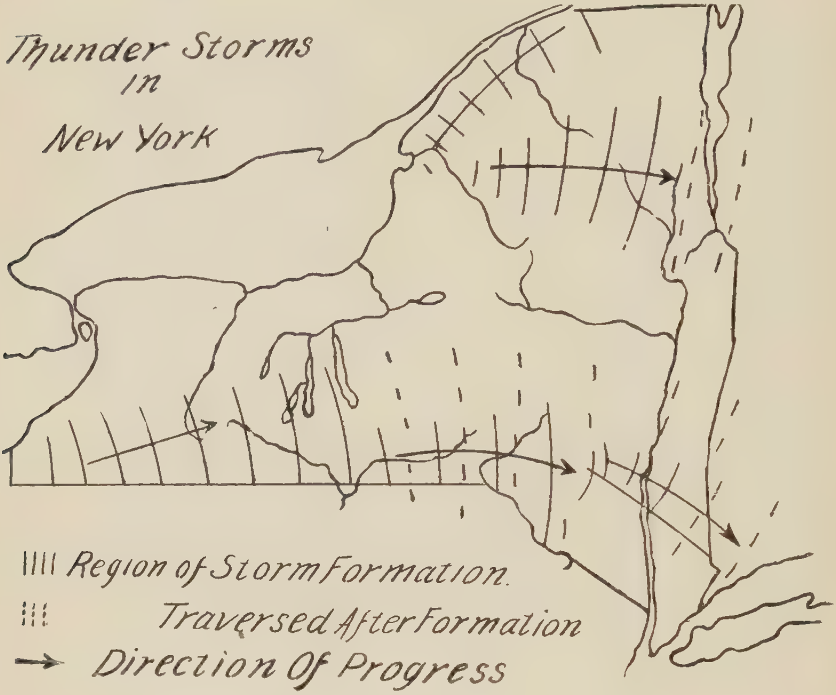

Thunder Storms in New York
|||| Region of Storm Formation.
¦¦¦ Traversed After Formation
→ Direction Of Progress

FIG. 20.

FREQUENCY OF RAINY DAYS.

The accompanying table shows the average frequency with which a rain or snow fall amounting to one one-hundredth of an inch or more occurs, during each month, at six stations in New York and also at Block Island, R. I., and at Erie, Pa., the former station representing, approximately, eastern Long Island and the latter southwestern New York. The rainy days are here expressed in percentages of the total number of days in each month, following the method of the Signal Service charts, from which the values at all stations excepting Ithaca were derived.

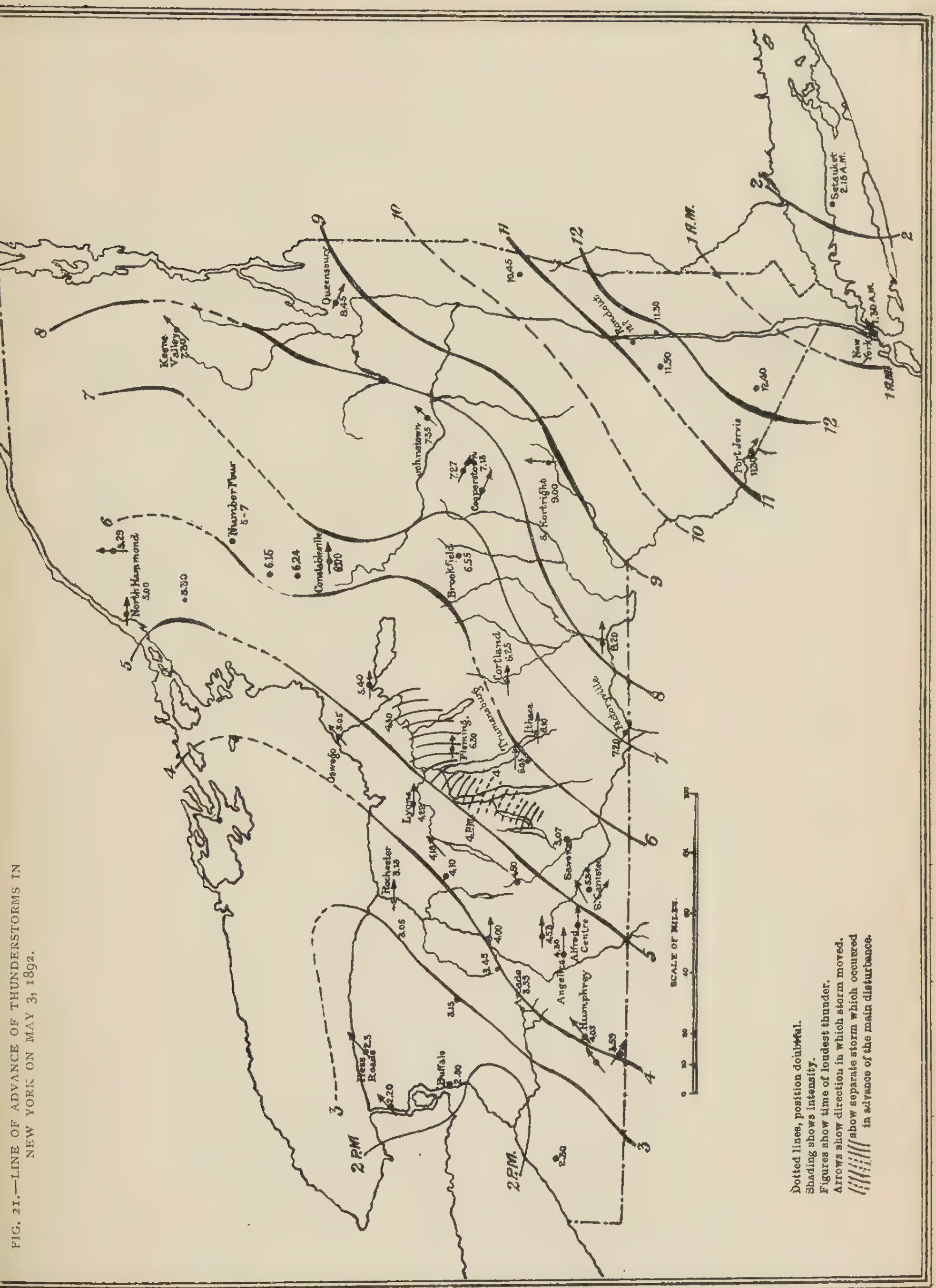


FIG. 21.—LINE OF ADVANCE OF THUNDERSTORMS IN NEW YORK ON MAY 3, 1892.

PERCENTAGE OF RAINY DAYS.

STATION.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total annual No.
Block Island, R. I.	47	44	39	35	38	32	36	29	29	35	39	41	135
New York City	39	39	38	37	34	35	36	32	31	31	34	36	131
Albany	45	43	44	40	40	41	39	31	34	35	43	44	146
Oswego	55	49	40	39	37	36	32	26	35	46	56	55	153
Rochester	65	58	57	42	38	39	37	32	38	47	53	61	171
Buffalo	59	55	55	41	39	39	35	31	38	46	55	59	170
Erie, Pa	65	58	57	44	39	41	33	32	41	51	57	65	178
Ithaca	59	54	46	37	46	40	43	37	37	40	46	50	161

Here it will be seen that the frequency of rain-(or snow-) fall is much more uniform over the State in summer than in winter, when the values are about 25 per cent. larger near the lakes than on the coast.

The probability of rain for all portions of the State may be fairly estimated from the averages at these stations, although some local variation must be expected, especially in summer, when local rains and thunderstorms are found to be quite unequally distributed over the State. It will be observed that precipitation occurs most frequently during the winter months at all stations; but, making allowance for this general tendency, the number of rainy days is found to follow, in a general way, the fluctuations of the rain curves shown in Figs. 17 and 18, which fact may aid in the estimation of rain probability for various special localities.

PERCENTAGE OF CLOUDINESS. (OVERCAST=100 PER CENT.)

STATION.	COUNTY.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
Block Island, R. I	....	55	48	51	45	51	40	43	44	47	49	51	56	47.5
New York City	New York	57	51	53	52	51	47	48	47	46	47	51	56	50.5
Liberty	Sullivan	62	62	60	57	49	47	44	45	43	52	66	66	54.0
Albany	Albany	60	57	61	58	52	48	48	50	50	58	60	79	56.0
Burlington, Vt.	....	57	58	64	53	56	44	46	40	51	70	61	72	56.0
Hamilton College	Oneida	76	74	65	56	48	43	38	36	39	57	75	79	57.0
Homer	Cortlandt	76	76	68	61	54	60	47	47	50	61	80	79	63.0
Elmira	Chemung	66	62	54	54	47	52	45	45	51	55	66	66	55.0
Geneva	Ontario	71	69	62	58	48	48	42	41	45	58	70	74	57.0
Oswego	Oswego	81	74	69	56	51	49	47	47	52	65	80	86	63.0
Rochester	Monroe	80	70	69	56	50	48	45	44	49	60	77	83	61.0
Buffalo	Erie	77	66	64	56	52	48	48	44	50	60	74	81	62.4
Erie, Pa	....	77	66	64	55	52	48	48	44	50	60	74	81	62.4

For our present purposes, the sources of cloud-formation may be included under two heads: 1st, low pressure, or storm, areas; and 2nd, local sources.

Low barometer areas usually bring with them a heavy cloud-

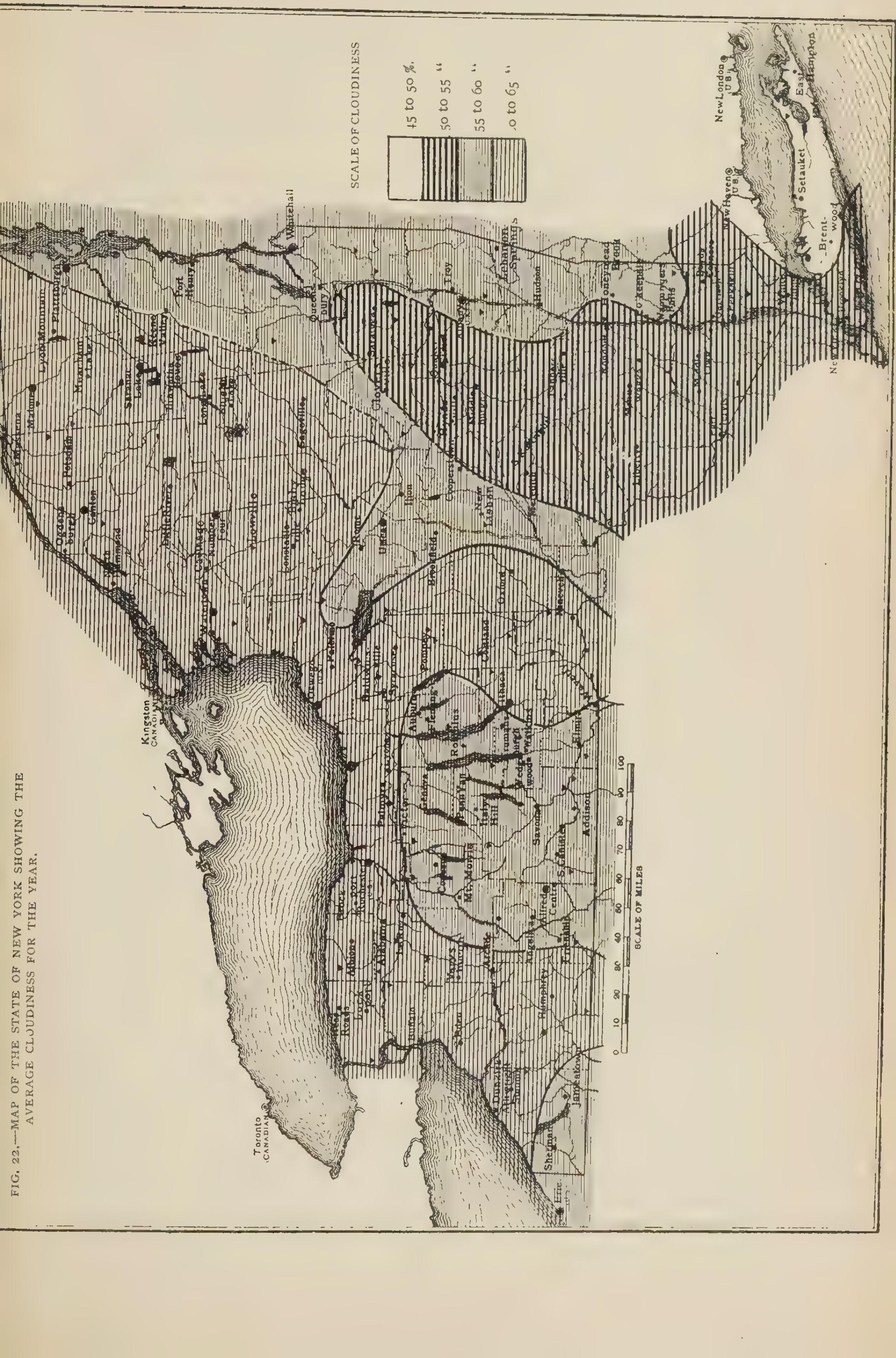


FIG. 22.—MAP OF THE STATE OF NEW YORK SHOWING THE AVERAGE CLOUDINESS FOR THE YEAR.

layer, many hundred of miles in extent; and since such disturbances pass in the vicinity of New York at intervals of three or four days during the winter, a large percentage of cloudy weather must be expected at that season, especially in northern and western New York, which sections lie nearer to the common track of storm centres than does the coast region. The lesser extent and frequency of low barometer areas during the summer months account in a large measure for the increased sunshine which then obtains.

The Great Lakes are the most important source of the *local* clouds, in winter. The vast quantities of vapor which rise from the lake surfaces are condensed by the prevailing cold northwesterly winds, and drift with them in a broad sheet over the greater part of western and central New York. Southeastern New York owes its clearer atmosphere to the fact that the prevailing winds carry the ocean vapors *away* from, and not toward, the coast.

In summer the prevailing southerly winds carry the lake vapors over Canada rather than New York; and also the high air temperature to a large degree prevents condensation and cloud-formation. Hence, during the warm months, fair weather prevails much more uniformly over the State than in winter.

The distribution of cloudiness over the State, for the year, is shown by the accompanying chart.

RELATIVE HUMIDITY. (PER CENT.)

STATION.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
Block Island, R. I.	76	78	75	76	83	83	82	82	82	79	78	79	79
New York City	74	73	68	65	66	69	71	72	72	70	70	73	70
Oswego	74	74	73	68	67	70	71	71	71	71	71	76	71
Albany	75	74	71	63	62	66	67	68	72	72	74	76	70
Rochester	80	77	76	67	64	67	68	68	70	72	76	80	72
Buffalo	80	78	75	71	68	71	72	71	72	73	76	79	74
Erie, Pa.	79	78	76	70	66	70	70	70	72	72	75	79	73

Although the *absolute* amount of moisture in the air is least during the winter, the percentage *relatively* to *saturation* (the relative humidity) is then generally at a maximum. At Block Island, however, the northerly winter winds have traversed a lesser expanse of water surface than the southerly or ocean winds of summer, and this circumstance, with the more moderate degrees of heat and cold to which the island is subject, reverses the rule applying to inland stations, causing the maximum humidity to occur during the summer. This is the case also along the south shore of New England and probably over the greater part of Long Island.

The maximum humidity at the Weather Bureau Stations within the State is found at Buffalo, which is subject to prevailing winds from the Lake. The region of least moisture, on the other hand, appears to be the Champlain Valley, as shown by a two years' record at Plattsburgh. The conditions are here very dissimilar to those of stations at the same latitude in the St. Lawrence Valley, the latter region showing substantially the same humidity which prevails near the Great Lakes.

The limits of this paper have rendered it necessary to consider climate as a fixed and definite entity, whose elements are represented by the averages of long series of observations. As a matter of fact, successive years may differ so widely in many or all of their characteristics as to bear little resemblance to the ideal which our averages represent. For example, the highest mean temperature on the records of New York City for January was 40°, which is the *normal* value for that month at Norfolk, Va.; while the coldest January at New York has the same average as the normal at Portland, Me. (20°). The fluctuations of other elements are quite as marked. Rainfall is especially variable, the annual total at Ithaca in one case, for instance, differing from the normal by 50 per cent.

To determine the extent and law of such fluctuations, an examination has been made of the records, which, in this State, extend back to 1826. As regards temperature, it is found that the coldest months of the year are the most variable, and that the variation may amount to 10° either above or below the normal, giving a range of 20°; but has not, so far, much exceeded that amount. In summer, the range of monthly means does not exceed 12°. We also find that deviations of 2° or 3° on either side of the normal occur about as frequently as a closer agreement with the normal; but beyond that limit warm or cold months are less frequent in proportion to their deviation from the normal. The normal has, then, a meaning and value as being approximately the *most probable value.*

The same rule holds in a measure also for precipitation; but the variations of this element are so wide that the formulation of any law becomes hazardous, and certainly is beyond the scope of this article. The rainfall in a single day may exceed that of an entire season, and, as already stated, the annual totals are subject to variations of over 50 per cent. If, however, we compute the total precipitation of the Januarys (say) of a long series of years at a given station, and then for a second period of like duration, the two will agree quite closely, and the more so as the length of the periods is increased.

The normals (which are simply these totals divided by the number of years of the record) thus serve an important purpose in bringing out the *characteristic* fluctuations of rainfall from month to month, and in different regions.

It is often asked, *Is our climate gradually changing?* To this question no perfectly definite and satisfactory answer can as yet be given; but we may at least assert that the changes, if any exist, are not sufficiently important to be readily discernible in the long records at our disposal. Only the broadest survey of climatological evidence can justify any conclusions in this matter, and for such a survey we must look to the work of Brückner in Germany.* This investigator has made use of all available records of weather, ice-formation and fluctuations of level in rivers and lakes, dates of harvest and other historical material, for the entire northern hemisphere. He concludes that relatively warm and dry periods alternate with cold and wet periods; the same phases recurring at intervals of about 35 years, or more accurately, as follows:

WARM AND DRY.	COLD AND WET.
1791–1805	1806–1820
1821–1833	1836–1850
1851–1870	1871–1885
(1886–1905)	....

The cold years differ from the warm years by about 2°; and the dry years from the wet by about 20 per cent. of the total precipitation. These results have little value, however, excepting in their scientific aspect; for they show wide deviations from the data of a restricted region like our own, and furnish but little basis for local predictions. The progress of deforestation is also often said to be the cause of important changes in climate; but the most careful investigation of the subject has hitherto given only negative results.

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* See "Modern Meteorology," by F. Waldo, Scribners.

THE PHILIPPINE ISLANDS AND THEIR PEOPLE.

AN ADDRESS BY

PRESIDENT JOHN G. SCHURMAN,
Of Cornell University.

Mr. President, Gentlemen of the Geographical Society :

I am under deep obligation to your president for the very generous remarks in which he has presented me to the audience, and grateful—if speakers are ever grateful to the audience—to see so large an audience here on such an exceedingly disagreeable evening. But the Philippine question is one which interests you, as it is interesting our people in general, and is likely, I think, to command interest for some years to come. It is true that one of the problems is practically solved. I mean the problem of military occupation, and, although not many months ago we were anxious to avoid military matters in the Philippine Islands, I think all fair-minded men, nay, I think men of all parties, must now recognize that the insurgent army, as an organized force, has been destroyed. I do not mean to say that there will not be some fighting in the future, but it will be guerrilla warfare. I do not mean to say that we shall not in the future see soldiers, but they will be mainly of the marauding or bandit type; and just in proportion as we occupy one important post after another and open up the country to trade and customs, even these marauding bands will disappear.

Consequently, there remains another question which, in my judgment, is a more difficult one, of vaster importance, and which will occupy our attention for the next several years; and that is the question of government. Now, as Burke said wisely, over a hundred years ago, the government of any people (which is as true of the Filipinos as it was of the people of the Thirteen Colonies) must be adapted to their character and their circumstances. I will, therefore, before I say a word about the government of the Philippine Islands, describe as briefly as I can the environment of the people and the inhabitants themselves.

I will ask you, in the first place, to note that our map-makers are responsible for a good deal of misapprehension in regard to the Philippine Islands. All maps of the United States and of this continent are made on a large scale. Maps of Asia are made on a small scale, and the Philippine Islands when studied in our geography look like dots, unimportant dots, along the Asiatic coast. I want to impress upon you, to begin with, that this archipelago is of a wonderful extent. Put the northern part of the Philippine archipelago on the northern point of Scotland, and the southern portion of the archipelago, between the fourth and fifth degree north of the equator, will be on the toe of Italy. It is an archipelago of continental proportions. It stretches through seventeen degrees of latitude. At its broadest point, it covers some ten degrees of longitude. In shape it is a great triangle, with its apex at Formosa, and if from Formosa you draw two lines, making together an angle of about 60 degrees, and let the one next the Asiatic coast run down to about the centre of Borneo, and run your base from the centre of Borneo, you have a triangle which embraces and which has embraced all the Islands of the Philippine archipelago. Of these islands, it is calculated there are some 1,800, but the vast, the overwhelming majority of them are mere islets. The important inhabited islands you may count easily on the fingers of your hands.

But I have said this archipelago is a great triangle, lying along the coast of Asia, with its apex at Formosa. I want, with your permission now, to fill up this triangle with the more important islands before I go on to speak of the peoples of the archipelago themselves. The upper half, or third, pretty nearly the half of that triangle, is occupied by the largest of the islands, the Island of Luzon. It practically fills the upper third, or upper half even, of the triangle. It contains some 40,000 square miles. The area of the entire archipelago is about 120,000 square miles. The middle portion of the triangle is filled by a group of islands running in an easterly and westerly direction, and these islands are called the Visayan islands. Beginning next the Asiatic coast you would have, first, Panay, next, Negros, Cebú, Bohol, Samar, Leyte. These occupy and fill up the middle section of our triangle. The basal portion, the lower portion, the southerly portion of this vast triangle, is occupied by the Sulu archipelago and the great Island of Mindanao, almost as large as the Island of Luzon. Here, then, you have three distinct tiers: Luzon towards the apex, the Visayan islands towards the central portion and the Island of Mindanao in the southern portion of this great triangle.

The products of these islands consist, as you know, of hemp and rice and sugar and tobacco and cocoanut, these being the most important. Then, in smaller quantities, come the coffee, pepper and other products, which I will not stop to mention. Coal abounds in different portions of the archipelago, not lignite, as I had supposed before going out there, but genuine coal, as the Commission was assured by owners of the mines in different parts of the archipelago. There is gold in different parts, notably in the island of Mindanao. The forests of the Philippine archipelago are among the most magnificent in the world. Such profusion and such variety it would be difficult to find anywhere else. Let me give you one illustration, which will bring out more clearly than any attempt at description what I mean by these great trees. When I was visiting the little town of Dumaguete, on the southern end of the Island of Negros, I met the municipal authorities and the authorities of the province, and we had an exceedingly interesting and pleasant time together, and, I suppose, to express their appreciation of the good time we had had together, when I came to leave they presented me with a round table eight feet in diameter, one piece of wood, polished like mahogany. It is a wood that is used all through the archipelago for cabinet work. I was, as you may imagine, very desirous of bringing home such a trophy, but I told them I was an American officer and could not accept a gift. You never saw people more surprised; they had not been used to anything of that kind.

Now, let me say a word about these people themselves. I think it is Matthew Arnold who complains of the monotony of our American life. Everything is the same; our cities are built alike; the streets cross each other at right angles; we even use the same letters or numbers to mark them. There is no distinctiveness about them. The country even is flat; the scenery is monotonous; politics is wearisome. Well, ladies and gentlemen, we shall have variety enough in our politics in the future. We have in the Philippine Islands alone (and that is but one of our new possessions) 84 different peoples, or, at any rate, 84 different languages or marked dialects. The total population is about 8,000,000. Of these, roughly speaking, a million and a half are uncivilized; they are barbarians or savages. The rest are civilized and Christianized.

Taking the people as a whole, they divide themselves into three great races. By far the most important is the Malayan race. The great majority of all the inhabitants, civilized and uncivilized, are of the Malayan race; but before I mention them I shall mention two others, which, with the Malayan race, constitute, as I have said, the entire population. First of all you have the Negritos. They appear to be the primitive inhabitants of the archipelago, indigenous people, who were driven to the mountains by the invaders, much as the Celts in Britain were driven to the fastnesses and wilds of the remote mountains of Scotland. They have rapidly disappeared, and within recent times and recent years islands were known in which they have passed out of existence. It is estimated that there are still some 25,000 of them alive. They occupy the mountain peaks of the Island of Luzon away up north, the mountain peaks of Panay and Negros in the middle tier, and the minor peaks of the great island of Mindanao in the south. They live on tubers, roots and fruit and such game as they can bring down with their poisoned arrows, wandering about naked or almost naked in the woods. Physically and intellectually, they are the lowest people in the archipelago. They have curly hair, flat noses, thick lips, big, clumsy feet, and they are low of stature. These are going. In a generation, or a few generations, they will have disappeared. We should have heard nothing about them in recent years but for the enterprise, I suspect, of the newspaper men, who found them an interesting subject for description. Probably no newspaper man had ever seen anything of them, and I have always supposed that that contingent of them which was said to have joined Aguinaldo's army was a perfect myth.

In the second place, you have a race entirely distinct from the Negritos, who are called the Indonesians. They are found only in the great island of Mindanao, to the south. They are a very remarkable people, although numerically weak in comparison with the Malayans. Naturally no accurate census has ever been secured. An estimated figure is from one-quarter of a million to half a million of Indonesians. They are a fine-looking race of men. The Negritos are low of stature; the Indonesians are tall. They have waving hair, aquiline noses, well-moulded lips, fine muscle and limbs, perfect athletes, reminding one rather of Greeks than of modern savages or barbarians. I remember a very interesting conversation I had with one of them near Zamboanga, on the island of Mindanao, in June last, and I could not repress my admiration for the fellow all through the conversation. It seemed to me that if he was in this country he would be just the man that our great universities would be competing for as a foot-ball player.

Unfortunately, the Indonesians have no education, no intellectual opportunities of any kind, and consequently, however great their inherent aptitudes may be, there has been no development of them. Where their neighbors were warlike, they have become warlike; where their neighbors are peaceful, they are peaceful and docile.

Of the three races I have mentioned, by far the most important and the strongest of all are the Malayans. They number over 7,000,000 of people, civilized and uncivilized. In appearance they are darker than the Indonesians, brown of color, of course, but not so dark as the Negritos; and while they have not the curly hair—for their hair is straight—they have in many instances, the flat nose and the thick lips of the Negrito. But they are an abler people, they are a more intellectual people, as you can see by looking at them, or better, by having intercourse with the educated specimens that the race has turned out. These people, it is said, came into the archipelago centuries ago from the south and drove out the other inhabitants, and drove them to the mountain fastnesses. They have not remained a pure race. They have mixed with the Chinese, the Indonesians, the Negritos, and to some inconsiderable extent with the Spaniards, so that all over the archipelago you see striking evidences of this mixture of races.

Now, these three races constitute, as I have said, the entire population of the archipelago, a population which uses 84 different languages or dialects. But although that is true, over six millions, perhaps six and a half millions of these people can be assigned to seven different tribes, speaking only seven distinct languages. Of these, there are six in the island of Luzon alone. About Manila, the provinces to the north and south and west of Manila, you have the Tagalos, numbering 1,600,000 people. They are the people who began this insurrection, first against Spain, and then continued it against ourselves. The Tagalos are the most advanced of all the tribes in the archipelago, not, I believe, because they are abler than the other tribes, but because, living as they do about Manila, they have felt as no other tribe could feel the influences of European civilization. To the south of the Tagalos, and occupying all the remaining southern portion of the island of Luzon, you have a tribe called the Vicoles, numbering nearly half a million of people. They are entirely distinct from the Tagalos, using a language which these cannot understand.

North of the Tagalos and occupying the central portion of the island of Luzon, you have the Igorrotes, 365,000 of them, and the Tinguianes, 340,000 of them, each again with a distinct language different from one another and different from all the other languages of the archipelago.

And finally, to the north of Luzon, on the side of the China Sea, you have the Busaos, who number between four and five hundred thousand people. And then, on the other side, on the Pacific Ocean side, in the valley of the great Cagayan, where the best tobacco in the world is raised, you have the Calaúas, numbering nearly 200,000.

Here are six different tribes, speaking different languages, unintelligible to one another, in the island of Luzon, each tribe having its own peculiar manners and customs, though I must admit, through Spanish influence, a good deal that was peculiar and many discrepancies of the tribes have been rubbed off.

Now, in addition to these six different tribes in the island of Luzon, you have this middle belt of islands, called the Visayan Islands, inhabited by another tribe, the Visayan tribe, with two distinct dialects—one the dialect of Cebú, the other the dialect of Panay. The Visayans who occupy these islands constitute the largest tribe in the archipelago. They number 2,600,000, and while they have not made as considerable advances as the Tagalos (who were, as I said before, the tribe that fought us), I think it is due rather to the distance from Manila, to the absence of European influence, than to any lack of ability in the people themselves. I saw them in several of the islands. I held intercourse with them in Panay, and elsewhere, and they impressed me in comparison as more solid than the Tagalos, not so volatile and excitable. If a comparison were to be made between them and the people of Europe, it would undoubtedly be as between the French and Germans. The Visayans are undoubtedly slower than the Tagalos, but, I say, they are solider, and while they may not have as lively imaginations, they have far better judgment. When that European influence which has done so much to civilize and elevate the Tagalos makes itself more strongly felt in Iloilo and Cebú, very much may be expected from them; in my judgment, more than from any other tribe of the archipelago.

And lastly, in this southern tier of the Sulu archipelago, you have, in Mindanao, the Mohammedans, between two and three hundred thousand of them, and then in the interior of Mindanao, away from the coasts, which alone were known to the Spaniards, you have barbarians and savages, tribes innumerable.

So much of the habitat; so much of the people of the Philippine Islands.

If, now, you ask me about that civilization I referred to a little while ago, I shall have to say at once it is a civilization, not of the highest type, but of the lower type. It was in 1521 when Magellan landed in Mindanao and then sailed up to the south of Cebú. He was accompanied by the missionary. The King and his followers were immediately baptized. In a few days they engaged in war with a little tribe of another island, Mactan, a few miles across from the south of Cebú. Magellan, of course, sided with and led the Cebúans. He himself was killed in that conflict and buried in the Island of Mactan. It was 50 years after that before the Spaniards undertook to make their occupation of the archipelago effective, and in about 1574 Legaspi went out, landed at Cebú, where the people had relapsed into savagery and renounced their allegiance to Spain, won them over and took the city of Manila and extended Spain's authority through the island of Luzon. He died there the next year. Magellan and Legaspi are the two great names in the Spanish political history of the Philippine Islands. They were accompanied, however, on the visit by the missionaries and the Catholic priest, and these have been the great civilizing influence from the beginning of the 16th century to the present day in the Philippine archipelago. Whatever civilization they possess they owe, I will not say exclusively, but largely, to this source. If in recent years troubles arose (and they have arisen) between the Filipinos and the Orders, which in other days brought them their civilization and all the blessings of civilization, we ought not on that account to forget, nor ought the Filipinos to forget, the debt of gratitude which they owe to the Spanish priest and missionary.

I do not mean to say that the civilization which you find there now is to be compared with the civilization of any foreign country, even Spain. Far from it; and without going into details, I can best illustrate the civilization of the archipelago by describing what I saw in some typical town or pueblo. That might enable you to realize better than any general description. Of course, one could not for such a purpose take Manila, because Manila with 300,000 people is a great cosmopolitan town. There are forty to fifty thousand Chinese; though a number of Europeans and Americans can be counted, there are very few of them; of Spanish half-breeds there are thousands. It would not be fair to take the city of Manila as illustrating the social, economic and intellectual condition of the people. But suppose one went to some town in the Island of Luzon at some distance from Manila, or to a small town in one of the southern islands; there you would have a typical body of Filipino civilization before you.

I remember landing from the *Bennington* (which was at my service for a trip of two thousand miles which I made from Manila) one afternoon in the old town of Silay, in the northern part of the island of Negros. Let me tell you what I saw there. We landed in a body on the rude boat. There was a narrow tramway there and a freight car on it of a very primitive type. Chairs had been set in this car, and we were asked to take our seats. A water buffalo was attached to this car. The carabao, or water buffalo, you can find everywhere in the Philippine Islands. You can scarcely think of the Philippine Islands without thinking of buffaloes, as you think of the bamboo tree, which they use for almost all purposes. The water buffalo was attached to the car. In a little while we were ready to move. I saw on the back of the buffalo a little Filipino boy, clad in the simplicity of nature, with a cigarette in his mouth. You scarcely ever see a Filipino man, woman or child without a cigarette. The procession moved on through the town. Crowds of people stood on each side, dressed in that Filipino garb which has now become familiar to you through all our illustrated magazines. We passed by them and by rows of huts, built entirely of bamboo, with floors of bamboo. The roof is made of cogon grass or of leaves of the nipa palm, which grows in the Province of Pampanga, north of Manila. Through rows of houses we passed until we came to what might be called the west end of the town. Here were several houses and a church. You find in all these pueblos a fine church. It is either a frame building or, as in most cases, a stone building with thick walls. And that will explain, by the way, why the churches were so frequently occupied by both armies during the recent conflict in the Philippine Islands. The church is the one building available for the purpose in any pueblo to which you go.

We were taken first to one of those buildings which would remind you of a small building in southern Europe, in Spain or Italy. I met there a number of fine, educated, well-bred Filipino gentlemen and half-breeds, one of them an artist who had painted (and I had seen the picture before going up) two or three portraits of Filipino martyrs. They have their martyrs already, and besides painting these he had painted a fine picture of Liberty, which was hanging in their Hall of Congress; the American eagle had gnawed in pieces the chains which bound the Filipino, and was now holding them out. I found him and others educated, intelligent, refined Filipinos. Spanish is the language which all these educated Filipinos can use and do use. We talked together for half an hour or an hour, and then were invited to another house to dinner. I am sure you would be surprised at the number of courses and the variety of wines. The food was different from ours, but in its way excellent. The wines were European wines, such as you would get in Spain or in the south of Europe. After dinner came the speeches. They have their intellectual repast with meals as we do at our banquets. There was no professional fun-maker. The speeches were all serious and all admirable. I very well remember how, when I told them, in such Spanish as I could command for the purpose, what the object of the United States was; how we were there to liberate them, and to give them all the political liberty they were capable of exercising; I remember how the roof of that hall rang and rang again with the plaudits of the people, and an old man, who could not speak Spanish, an uneducated man, got up, and in his native speech thanked me with tears in his eyes for what I had said. One gentleman, who spoke Spanish, got up and put it into Spanish. That was the second frame house I had visited, and my ideas of them rose as we went along.

I was now coming to the third, and it was prepared for the inevitable dance which follows all banquets and closes all forms of entertainment in the Philippine archipelago. The people are fond of entertainment; they will dance at all hours of the night. The ladies, who are fond of dress, came out bespangled with jewels and diamonds, not such as you find on Fifth Avenue, but the diamonds were there, and they made a creditable show; and with the gracious manners which Filipino girls display, one could not but feel admiration for such a spectacle as I saw that evening. I was so charmed I staid until three or four o'clock in the morning, but the festivity seemed to have just begun when I went out to join my associates. I mention that as a picture of life found in the pueblos, or towns of the Philippine Islands, of the civilized portion.

Now, without saying any more about their civilization, insisting that you shall take this picture as an illustration of what you will find among the six and a half millions of civilized people, I will turn to another question, and ask why people who have been nurtured as these had been for over three centuries by Spain, should, in the year 1896, have revolted? I am describing the Philippine Islands and their people and circumstances as I found them. For the revolt began in 1896, and while I am endeavoring to pay the compliment to Spain for the Christianizing and civilizing influence in the Philippine Islands, truth also requires that I say that Spain retained in her administration of Philippine affairs a form of government which might have been serviceable, which might have worked well thirty or forty years ago, and which the Philippine peoples under her own tutelage had outgrown. They were fit for better things. She had in part trained them up to better things, and yet she had never prepared them for a change.

What, now, were the causes of that insurrection? They were partly religious and partly political. Now you all know, ladies and gentlemen, that there is nothing more dangerous to speak of, or nothing more embarrassing to speak of, in a general audience than the subject of religion, and I don't want to speak of it at all; yet I must describe facts as they exist in the Philippine archipelago, and so if you ask me what led to the insurrection, I think I had better read the programme of the insurrectionists themselves. You will see from that programme what the causes of the uprising were. I have before me the first volume of the report of the Philippine Commission, of which I had the honor of being a member. That report has not yet been made public. This is a private copy. Congress is making an appropriation for printing 15,000 copies, and when that goes through, I suppose it will be put on the market. On page 84 of that report, I have inserted a programme which appeared in a Manila newspaper in the year 1897, after the insurrection had been in operation a year. They explained their demands in that programme, and it shows as clearly as can be put in words what the causes of the insurrection were. Let me now read it to you:

"1. Expulsion of the Friars and restitution to the townships of lands which the Friars have appropriated, dividing the incumbencies held by them, as well as the Episcopal Sees, equally between the peninsular and insular priests." (*Peninsular*, Spanish; and *insular*, Filipinos.)

"2. Spain must concede to us parliamentary representation, toleration of all religious sects, and administrative and economic autonomy.

"3. Equality in terms of pay as between Spanish and Filipino civil servants.

"4. Restitution of all lands appropriated by the Friars to the townships, or to the original owners, or in default of finding such owners, the State is to put them up at public auction in small lots of a value within the reach of all and payable within four years, the same as the present State lands.

"5. Abolition of the government's power to banish citizens, as well as unjust measures against the Filipinos. Local equalities for all. * * *."

Now, ladies and gentlemen, it is perfectly clear from that programme what the moving causes of the insurrection were. I have often heard it said that the Filipinos are fighting for independence, and I hear it charged against our own Government that we are resisting their legitimate aspirations for independence. I beg to call your attention to the fact that in the programme which I have just read the word "independence" is never mentioned, and the conception of independence is absolutely wanting. They are going to remain under the ægis of Spanish authority. They desire only those inalienable rights which men of all colors and all creeds are entitled to, by virtue of their humanity as such. It is not a declaration of independence, as so many of our people have supposed. It is a calm, deliberate exposition of grievances, a demand for redress, a declaration in the nature of a Magna Charta; that, and nothing more. And if you ask me what the remedy is, I reply that I know no other remedy than the old American remedy—religious liberty, civil rights, and all the political franchises the people are capable of exercising. Give them those and their aspirations will be satisfied. Give them those—they attain the objects for which they made war on Spain.

Nor has the lapse of time since 1897 made any change in this programme, so far as the masses of the people are concerned. When I came back from the Philippine Islands a few months ago and made that statement and asserted that the people were not fighting for their independence, I was somewhat surprised to find myself—and I was engaged in trying to find the truth and was then reporting it as I saw it—I was surprised to find myself described as one who was supporting the Administration at any cost. I was after the truth and I reported the truth as, after diligent investigation, I found it. That programme confirms my report. But if further confirmation were needed, I have received it this week from a most unexpected source. You all read the *Evening Post.* You know that on this business and on some other matters it does not support the Administration. But the *Evening Post* has in Manila one of the ablest, if not the very ablest reporter who has been sent from the United States. In a letter which was published in the *Evening Post* of Friday, March 16th, a letter dated "Manila, February 2nd"—and it is very creditable of the *Evening Post* to publish letters of this kind, which refute its own editorials—in the letter of last Friday, in the *Evening Post,* I was delighted to find the following confirmation of the views which I have maintained ever since I came home, and have just presented to you; namely, these facts: that the Filipinos did not want independence, that they were not fighting for independence; they were resisting wrongs and abuses and amply admitting that these reforms could be given them easily enough without raising for a moment the question of independence; while Mr. Robinson, this able correspondent, says, referring to the questions which remain unsettled:

> "They are quite open to immediate settlement at any time along strictly American lines, political freedom and religious freedom. Political freedom does not necessarily mean absolute political independence. The best information that I get assures me that this is not demanded and is not really wanted."

I hope now, in view of this report by the correspondent of a paper which sympathizes so fully with the anti-imperialists, that our report—a report which we have been making for some months past—will receive the credence to which I assure you it is entitled.

Here, then, is the situation of affairs we find in the island. And now, what of the remedy? I have been saying for months, and you will notice that Mr. Robinson repeats the same in his article which I read, that the remedy is undoubtedly to be found along the American lines of religious freedom and civil rights and of political freedom.

Now, so far as the first point is concerned, I do not choose to dwell upon it. I will simply say that, in our proclamation, issued upon the authority of the President, we stated that hereafter religious freedom should be guaranteed in the Philippine Islands, with the equality of all denominations before the law and the separation of Church and State. And undoubtedly large results from this initial reform will follow from the operation of that simple principle alone.

There is another matter which is, perhaps, almost as difficult to deal with, and that is the question of the property held by the religious corporations or Friars. The Filipinos, in the programme which I have read to you, proposed to confiscate that property. The holdings are enormous. In some provinces about Manila the religious Orders are said to hold about one-half of the entire country, and the feeling towards them is naturally about the same as that which in Ireland the peasants used to feel against the absentee landlord. You will observe in this programme the proposal is to confiscate these lands, and I may say that in the constitution of the so-called Philippine Republic it is also provided that these holdings of the religious Orders shall be confiscated, although the phrase there is an exceedingly happy one; it is euphemistic even. It says that the property "shall revert to the State," but the result is the same, so far as the Orders are concerned.

I do not believe in such a policy, ladies and gentlemen. I think it would be unjust, and the United States is estopped from following such a policy, even if the American people desire it, as I do not believe they do. We are estopped, I say, from pursuing such a policy, because the treaty of Paris specifically provided that all property rights in the Philippine Islands should be respected. You must, therefore, find some other solution of this question. Either the religious Orders must remain as they are, in possession of their vast estates, the masses of the people objecting to them and feeling towards them the opposition and resentment which led them to rise in rebellion in 1896, or the State must buy up the lands at an equitable valuation—and my own recommendation is that this latter course be adopted. Let a court be established in the Philippine Islands for the purpose of determining the value of the lands held by the religious Orders, as Mr. Gladstone established a court in Ireland for the purpose of determining equitable rent, and let the State buy the lands at the valuations appraised by the court. The State could afterward sell them out in small holdings, as, you observe, was suggested in the programme of reform which I read to you; and even if the State lost a little money by the transaction (the Filipino State), it could afford to lose it for the sake of settling a question so difficult, so embarrassing and of such enormous proportions. If the State did incur a debt in buying them up, there is this satisfaction, the Filipino State owns, or will own, a great deal of land—crown land. Those lands are now mostly in the interior, either in the mountain district, or far in the interior, where communications are impossible.

One of the first things we shall do in the archipelago is to build roads. I believe in schools, but roads must come first. Intercourse, and the possibilities for intercourse, are the means of civilization. A most potent means they are. As we build roads and railroads these public lands will be made accessible, and become, in many instances, exceedingly valuable; and if the State created a debt in settling the question of the holdings of the religious corporations, it would have enough, and far more than enough, to recoup itself, in the reserved public lands, when once the country has been opened up. That is my settlement of the religious question in both its phases.

Let me now pass to the other question which was raised in the programme. I have read the questions of political reform. Here, too, I see nothing better, as I have said before, than the good old American way of civil and political rights. You must give these Filipinos their civil rights. We do not want, as Spain did, to return to the arbitrary power to banish the Filipinos from the islands, on mere suspicion and without trial. We want there nothing but justice and right and the spirit of the ancient law, which has shaped the civilization of Europe and America. Give them that; do away with your military government, as soon as possible, and let the reign of law take its place, and the Filipino will be vastly more satisfied than he has ever been since you entered his archipelago.

And then, as to political franchises, what shall we say? I, for one, do not say independence. I do not say it, first, because the

Filipinos do not want it. They say it is impracticable; and, secondly, because I see and know (and no man can go to the Philippine Islands and travel there much without becoming convinced) that they are absolutely incapable of maintaining or existing as an independent sovereign State. If you granted the Filipinos independence to-morrow you would first have to find some organization to grant it to. For the little government of the Tagalos is not now a government in being, but a government "in motion." But if you found, by hunting carefully, some organization to entrust absolute independence to, in the short course of a year or so one of two results would follow. It is highly probable this would follow: the different tribes would fall out among themselves, and, falling out among themselves, produce chaos. Or, if they did not do that, this other result is pretty sure to follow, that some lone settler in Panay or Iloilo, or Cebú or some other part of the archipelago would find his life in danger some day, or his property destroyed. He would ask his own Government to intervene to protect him. But the moment a great European Power intervenes to protect life or property you know what happens. The archipelago would inevitably be divided up among the great nations of Europe and Japan, and the dream of a united, free Filipino commonwealth, which animates the minds and hearts of the best Filipinos to-day, would disappear forever. The best hope of the most ambitious Filipino patriots is to-day in the American Republic. They see that under us they have a chance, or may have a chance, for the future; apart from us they have absolutely none. If, then, these people are not to have independence, what kind of government should we give them?

I made out a plan, and the Commission, I may say, delegated to me the question of government, and from the time I was in the Philippine Islands till I left I was trying to find out what the Filipino people wanted. There are various ways of doing that. You may find it out by conversation with Filipinos in different parts of the archipelago, and I went all over the archipelago and met educated men and prominent owners and discussed it with them. You may find it out in programmes of reform like the one issued in 1897, and by reading different books and pamphlets which appeared in recent years; and this information, we think, we have patiently used, and as a result we think we have recommended to the President a form of government which the Filipinos themselves desire. You, yourselves, can be the judges when the report of our Commission appears, for we have published along with the report, in the appendix as exhibits, a number of these books which serve as a basis for our own recommendations.

Many of the features of the government we recommend we take from the Constitution of the so-called "Philippine Republic." Some of the other features we take from a Constitution drafted by the people themselves. Some of the other features we took from a Constitution which we had prepared specifically for the Commission by the ablest Filipinos in the archipelago, and there is scarcely a detail of the form of government we recommend which is not borrowed from the Filipinos themselves. In brief, the plan is this: let the President of the United States name a Governor for the Philippine Islands. Let that Governor have a cabinet, consisting of Americans, or Filipinos, or both. Let the judicial department have at its head a Supreme Tribunal, consisting of Americans and Filipinos. Let the legislative department consist of two branches—an upper house or Senate, and a lower house, or House of Representatives. Let the House of Representatives be elected by the people, and the upper house half elected by the people and half nominated or appointed by the President of the United States. If this latter feature strikes you as peculiar, I may call your attention to the fact that the Filipinos themselves suggested it, and in the ablest memorandum submitted to us that very feature was embodied.

Do you think that people enjoying a political organization of that kind are not in possession of liberties, are not enjoying pretty tolerably full political franchises? Then I remind you that that government is more liberal than the form of government that Jefferson himself outlined for the people of Louisiana, for in Jefferson's scheme of government, which went into effect in 1804, both houses of the legislature were nominated by the President.

Now, in addition to this General Government, convening at Manila, we propose that the different provinces—and there are over sixty military provinces—shall be turned into counties with self-governing councils, and the towns and cities of the archipelago shall have municipal councils, also self-governing. That reminds me of the political organization of the State of New York and New Mexico. But now there comes a difference. We think of our towns as independent of their central government. The government of Albany is supposed not to be interfering with the government of the city of New York, or the city of Syracuse. We have what we call "home rule," and in theory we assert it, and generally maintain it in practice.

Such a conception of local government is unknown to the Filipinos. We all have our ideas and notions determined by experience. The only government they have experienced is Spanish. In Spanish government, the principle of centralization prevailed and all municipal councils were dominated by the central Government at Manila. They, therefore, looked for intervention, regulation, control from Manila, as a part of government. They cannot conceive a county or town government without supreme control on the part of a central government at Manila, and in the different programmes of government submitted to us this element was incorporated. I was perfectly amazed when I met it first; it was what the people themselves desired. But I said to myself, "If they desire it, they shall have it, so far as our recommendation is concerned," and we made that recommendation, and I can see that something like that is absolutely indispensable, because you must have an American official for every 250,000 people or so to give them the benefit of American experience and supervise closely the collection of revenues and expenditure of revenues, for that is the point in which most Oriental peoples are deplorably weak and need special watching.

For the others down in the archipelago, and Mindanao, we recommend a different form of government. Among the six and a half millions of civilized people, with whom we have been lingering, there is not a chieftain, not a sultan nor a ruler of any kind. It is a sheer democracy. There is no leader of any sort, except the educated man. Down in Sulu and Mindanao, the conditions are different. There are sultans and chieftains, hereditary rulers whom the people respect and reverence. They control as well as govern the people. Consequently, if you wish to establish law and order and maintain government in the southern tier, you simply must make agreements with these chiefs. I saw on my first visit as an American official the sultan of Sulu and I suggested an agreement similar to the agreement made between him and Spain, and he was willing to accept it. Long after, I sent my telegram to Washington recommending that that policy be adopted for all that southern tier, and it has been put in operation, and we now have all that southern country without the flash of a sword, or the shot of a single gun.

Here, then, ladies and gentlemen, are the two different schemes which you must put in operation in the Philippine Islands, in accordance with the diverse conditions of the inhabitants.

I can only say in conclusion that I believe, if this scheme of government is put in operation—and the President is sending out another Commission, headed by Judge Taft, to put this scheme in operation—I believe, if it is put in operation, the people will be contented. Although the problem of government in the Philippine Islands is by no means easy, I do not believe it is as hard a problem as the majority of people have supposed. There are three or four hopeful circumstances. The people, though densely ignorant and superstitious in the extreme, long for knowledge. The idea of Japan is constantly before their minds, and they think, as Japan has become a great people in the course of a generation, something of the same kind is possible for the Filipinos, if they can only get education. Second, everywhere I was astonished to find the perfect harmony which existed between our every-day practice and traditions and the ideals and aspirations of the Filipinos. Why, ladies and gentlemen, the things that we would do and naturally give them are the things they are longing and yearning for. Everywhere you go you find a small number of educated men, not many, very small in proportion to the entire population, but an element; for, in my way of thinking, these educated men are a connecting circumstance; they are capable of swinging the masses; the masses will follow them.

It is our duty, therefore, to decide this question right. How are we to do it? By satisfying their legitimate demands. We set ourselves deliberately, from the time we landed there until we left, to find out what those people wanted, and the results of our inquiry are embodied in this report, and it is because the President has adopted that report and is sending out a Commission to put it in operation, and because our recommendations will satisfy these educated men, that I feel such confidence in the future of the archipelago. Only one danger I see ahead. That danger is not in the Philippines; it is in Washington. If we apply to the administration of public affairs in the Philippine Islands the same sort of civil service notions that guide us in our domestic administration, we shall fail. And our failure will be more inglorious than Spain's, because the Republic falls from a greater altitude. It is absolutely essential to success in the Philippine Islands that you send out the ablest men you have; that you give them permanent appointments; that you promote them for merit. It is absolutely essential that such men going out must at the beginning, just as the English officials do, learn the languages of the natives so as to understand them, sympathize with them, and understand matters from their point of view. We cannot govern the Filipinos from our point of view, or from our notions; we must take their point of view, and in order to understand them, we must know their language, so that we may be free from the aid and the misguidance of interpreters, and can hold ready intercourse with the people themselves. I may point out that I have heard from among the leaders in both parties that such a special permanent Filipino reform service must be established. I take encouragement from these assurances; and if they are carried out, then I have no doubt whatever that by the same common sense and conscientiousness and integrity by which we have governed this Republic as it has extended from Plymouth Rock to the Pacific Ocean, we shall also govern with success and credit our new possessions in the Orient.

PELOPONNESIAN JOURNEYS.

BY

CLARENCE H. YOUNG.

Greece is, probably for the majority of persons who have never visited that land, merely a country of the past, rich in associations and interesting because of the part it once played in the development of the world's history, but at the present day reserved for the shovel and the pick of the archæologist and for the researches of classical scholars. Yet, entirely apart from its ruins, modern Greece and its inhabitants offer to the traveller, who finds enjoyment in the picturesque in Nature and entertainment in the study of the life and customs of a simple folk, much that is of interest.

The most prominent natural features of the country are the numerous bays and gulfs which, broken by many headlands and occasionally dotted with islands, set far into the land, and the mountains which cover its surface in a perfect network. There is not, it is true, in Greece any single peak that attains a very great altitude; but, on the other hand, the number that reach a goodly elevation is unusually large, and this conspicuous magnitude of the many peaks forms the most characteristic feature of the Greek landscape. Almost equally striking, however, are the clear-cut outlines of the mountains, which are due in part to the hard limestone formation, in part to the absence of vegetation. For, in the course of the centuries, the forests have in large measure been destroyed, though even now in some districts considerable stretches of woodland are to be found, and with the passing of the trees the rainfall has decreased, so that during the summer months, when hardly a shower comes to moisten the parched earth, the country is for the most part extremely arid. But though we miss in Greece the cultivated prettiness of England and the grandeur of the Alpine scenery of Switzerland, its mountains, with their bold outlines sharply defined against the sky in that wondrously clear atmosphere, have a rugged beauty all their own; the skies above are as bright, as warm and as cloudless as those of Italy; the waters that wash its shores are clearer and bluer, were that possible, than those of the Bay of Naples; while on the hillsides there is an ever-shifting play of shadows, varying in hue from gray to black, from grayish blue to deepest purple, which adds not a little to the beauty of the scene. To complete the picture we must add the dusky grayish green leaves of the olives with their gnarled stumps, the darker green of the vineyards, and in the early spring, when the foot-hills are covered with green shrubs and the plains are bright with the young shoots of the grain, the numerous wild flowers, the iris, the cyclamen, anemones, orchids, gorgeous red poppies, the lovely clustering yellow flowers of the gorse and countless other varieties, which in many places grow in such profusion that it is impossible to take a step without trampling their delicate blossoms under foot. There is probably, I think, no other country in Europe where the beauty of the scenery is so largely dependent upon the exquisite coloring of Nature, and, consequently, none of which a photograph or a lantern-slide gives so imperfect an idea.

But for me, personally, the greatest charm of modern Greece lies in the fact that it is as yet unspoilt by civilization and by the influx of sightseers that have overrun the rest of Europe. Here is a land where everything is not arranged to attract the tourist, and where the people are, for the most part, still content to live the same simple lives as their fathers before them. The atmosphere is that of the Orient, where time has not yet become so precious as in this bustling Western world, and where men still transact their business in a leisurely fashion, which we are unable, or unwilling, to follow even in our pleasures. In Greece, moreover, the railroads are not so old nor so extended as to have caused the people to forget that space exists, and the man who prefers to jog slowly along on the back of his mule or donkey, instead of being whirled to his destination in a train, is not regarded as an anomaly. As to hotel accommodations, those of Athens are excellent; those of the other large towns are, at the best, passable; while elsewhere the traveller is dependent upon the μαγαζεῖον (*magazeíon*) or village store, or else upon private hospitality, for shelter and for entertainment. All this has, of course, its drawbacks, and the traveller in the interior of Greece must be prepared to forego not only all luxuries, but not infrequently, even many of the ordinary conveniences of life. Most of the positive discomforts can, it is true, be avoided by travelling with a dragoman or courier; but the wise man, who possesses even a slight knowledge of Greek, will content himself with the services of an ἀγωγιάτης (*agogiátes*), as the man is called from whom one hires his saddle beast and who accompanies one to take charge of it. By so doing the traveller is brought into closer touch with the people and sees more of their life and customs; while the *agogiátes* is generally a good guide within a radius of several days' journey from his own home, and, though quite ready to cheat you in the bargain which you make with him, will, when once hired, almost invariably look sharply after your interests, and in case of a dispute will side with you even against his own countryman.

As for the Greeks themselves, they are an interesting nation, and with all their faults—and these are by no means so black as popularly painted—I found them extremely lovable. Dirty many of them unquestionably are, but it is, as a rule, clean dirt, by which I mean that it is the dirt of the fields. As for the fleas and other vermin, with which the majority of the peasants' houses are infested, their presence is not due solely to filth, for the natural conditions in Greece appear to be peculiarly favorable to their propagation; and, as I have been informed by both educated Greeks and resident foreigners, the only way in which a house can be kept free from these pests is by an unceasing vigilance and an almost endless housecleaning, for which the ordinary peasant cannot find the time. That the Greek occasionally deviates from the truth may be a fact; that he is the inveterate liar which he is often represented as being I do not believe, for the number of instances that came to my notice in which a lie of any kind was told was very inconsiderable. Similarly, as regards the charge of dishonesty which we so often hear brought against them, my own experience would lead me to form quite the opposite opinion, for during the entire ten months that I spent among them I never had a thing of any kind stolen. One criticism, however, that can very justly be laid at their door, if we judge by our own standards, is that of unscrupulousness and of cheating in business transactions; but here the fault lies not so much with the individual as with the standard and the customs of the country. The transaction of business upon a basis of fixed prices is practically unknown in Greece, and, since bargaining is always expected, the seller invariably asks much more than the sum that he expects, and is willing, to take. And if you will only meet him on his own ground and fight him with his own weapons until you have compelled him to accept a fair price, he will not only be perfectly content but will also feel far more respect for you than he would had you verified the old adage, "A fool and his money are soon parted," by paying him the price first asked. But once this necessary preliminary had been gone through with and the bargain made, I found that they could generally be depended upon to carry out the terms of their contract. Yet, combined with business sagacity and shrewdness of a high order, you often find an ingenuousness and simplicity which charms and attracts one by its very childishness. And like a child, too, the Greek is eager, impetuous, keenly susceptible to emotion, easily swayed by the impulse of the moment, and quick of temper, but rarely sullen, for his anger gathers and bursts and passes like a summer shower. Inquisitive as squirrels, they gather about you in every village at which you stop and ply you with questions as to your personal affairs. Yet all this is done with such perfect courtesy—and I may say, in passing, that it is exceptional to find a Greek who is not courteous and polite—and the questions are so plainly inspired by childish curiosity, pure and simple, that it is impossible to take offence. But apart from this frank and childlike simplicity, the trait that has always appeared to me most attractive and lovable in the Greek character is his unfailing hospitality. The person to whom you may come with a letter of introduction will place himself and his house at your command and seek in every way to be of service to you. Even the humblest peasant, at whose house you, as a stranger, may apply for a night's lodging, will receive you with a cordial welcome and will place his best at your disposal with a courtesy that goes far towards making you forget that you will be obliged to pass the night wrapped in a rug upon the floor instead of in a bed and that your morning toilet will, of necessity, be performed without the aid of a wash-basin or a looking-glass. Nor is the charm of your reception in any way marred by the knowledge that this same man, who is now seeking to the utmost of his ability to make you comfortable, will on the morrow present an exorbitant bill for the night's accommodations, for the Greek has the faculty of making you feel under these circumstances that he is, for the time being, your host and you his honored guest. And it is a strange thing, for which I cannot account, but nevertheless a fact, that when you finally ride away on the morrow, after having wasted perhaps a valuable half hour in bargaining before you have been able to settle the bill upon an equitable basis, it will be in a spirit of perfect friendliness, and in the future you will be sure to think of your quondam host, not as a rascal who tried to cheat you but as a person to whom you are indebted for generous hospitality.

To speak of Greece without alluding to its past is as impossible as to travel through the country without seeing the ruined monuments of former days; but as I wish to present for the most part the modern side of the picture, I will ask you to follow me as I retrace my steps over the ground which I visited some years ago during several trips to the Peloponnesus. As we approach Patras, which is one of the centres of the currant trade in Greece, we see that the port is an open roadstead, protected by a long breakwater, behind which our ship comes to anchor. With its straight and broad new streets, its crooked and narrow old streets, its white stuccoed houses, and its broad, dreary squares, to which the pepper trees, with their graceful foliage and bright red berries, alone lend an element of charm, Patras is a typical modern Greek city of the better class. But even more interesting than the place itself to the traveller who has just landed are the strange street scenes and the unfamiliar costumes. The ride along the Gulf of Corinth, with the blue waters of the gulf hemmed in by rugged mountains on the left and on the right the littoral plain, with its vineyards, and the mountains of the Peloponnesus beyond, is one of the loveliest and most picturesque imaginable, for the railroad follows closely the curves of the shore, and as the train winds in and out around the various headlands the eye is met by a succession of beautiful pictures.

Three hours and a half after leaving Patras we arrive at the little station of Kiato, and, leaving the train, proceed on foot across the littoral plain to the village of Vasiliko, which lies some two miles back from the shore on the edge of the plateau that was once occupied by the ancient town of Sicyon. Here, in December, 1891, I passed a week in the house of a Greek peasant, George Demetrius, while engaged in excavations on the site of the ancient theatre. We found the people extremely kind and hospitable, and the experience, though in many respects a rather rough one, was not lacking in interest, nor was our stay unenlivened by amusing incidents. One that well illustrates the simplicity of the Greek character was a strike on the part of our workmen for higher wages. They based their demands principally upon the fact that they could obtain the pay which they desired by working in the vineyards; but when we disclaimed any wish to compel them to work for us for less remuneration than they could obtain elsewhere, and asked why they stayed with us instead of going to the vineyards, they practically destroyed their entire case by confessing with perfect ingenuousness that December was not the proper season for such work.

A half hour's ride from Kiato brings us to the straggling town of modern Corinth, which has grown up on the shores of the gulf since the destruction of the former village by an earthquake in 1857. The site of the ancient city, where the American School of Classical Studies at Athens are now carrying on excavations, lies some three miles and a half to the southwest at the base of the

Acro-Corinth, the isolated hill crowned by mediæval fortifications, which in olden days was the acropolis or fortified citadel of the city of Corinth. From this point we make a flying trip through Argolis, and visit the prehistoric town of Mycenae, with its Cyclopean walls; the site of the Argive Heraeum, or famous temple of the Argive Hera; the prehistoric fortress of Tiryns, with its massive fortifications; the walled city of Nauplia, with its reminiscences of the early days of the Greek republic, and the Hieron, or sanctuary of Æsculapius, at Epidaurus, with its glorious old theatre. From Argos we drive past the famous Lernaean spring, where Hercules, according to the legend, overcame the hydra, and across the mountains to Tripolitza, the capital of Arcadia. From this town a pleasant morning's drive can be taken to the site of Mantinea to the north; but an even more charming trip is that to the southwest through the swampy, maize-covered plain of Frankovrysis and across the mountains to the ruins of Megalopolis, which lie in the centre of a broad plain some 1,400 feet above sea-level, and to the site of the ancient Lycosura, charmingly situated among the mountains to the west of the Megalopolitan plain.

Returning to Tripolitza we there obtained horses for our trip to Sparta, for, though there is a good carriage road, we preferred to go on horseback. Our animals, which were small, undersized horses, about as large as full-grown ponies, were equipped with the usual heavy wooden pack-saddle, very uncomfortable in appearance, but with which, by the use of several rugs and by riding sideways, one can get along very comfortably. Instead of a bridle you have a halter, and guide your beast by pressing the leading rope or chain against his neck. A more helpless feeling than comes over one if, under these circumstances, his horse bolts, it is hard to imagine; but to the credit of the Greek horse be it confessed that you and he generally get on very peaceably together, and that his docility and surefootedness soon gain your confidence. Sparta itself comes upon the traveller with the shock of a great surprise, for it lies in the midst of grain fields and vineyards, in the centre of the broad valley of the Eurotas River, one of the most fertile districts that I visited in the Peloponnesus, and the inconsiderable remains of the ancient city embowered among olive groves and plantations of lemon and orange trees—for you will find at Sparta the largest and most luscious oranges in the world—give one an idea of the home of the old Spartans very different from that which the name usually suggests.

From Laconia we crossed the snow-capped range of Mt. Taygetus into Messenia by the famous Langada pass or gorge, which offers to the traveller some of the wildest and most picturesque scenery in the Peloponnesus. After a visit to Messene, with its admirably constructed fortifications, now overgrown with ivy, where we were most hospitably entertained by the monks in the Vourkano monastery, we travelled northwards through plain and mountain to the wretched village of Pavlitza, the ancient Phigalia. Here our party separated, and the others went still further north to the Apollo temple of Bassae, which is admirably situated in a lonely spot among the mountains, and which commands one of those extended panoramic views that seem to await the traveller at the summit of every hill and mountain in Greece. Our own route led us to the west through the mountains for a day and a half to the sea, and then across sand hills covered with a sparse growth of trees along the seashore. Just beyond the ruined fortress of Samikon we again turned inland, and travelling through the country over which Xenophon must often have hunted—for Scillus, the place of his exile, was close at hand—we crossed the Alpheus, the largest river in the Peloponnesus, and just at sunset arrived at Olympia.

The sanctuary of Olympian Zeus, the great national shrine of the ancient Greeks, lay in the valley of the Alpheus, between the bank of the river and the Cronus hill, and the following morning we visited the confused mass of ruins which were laid bare by the great German excavations within the Altis or sacred precinct. At the foot of the Cronus hill lie the ruins of the Heraeum, the oldest Doric temple known, and it was in the interior of this building that the most precious individual find of the excavations was brought to light. Prior to that time no original work by any of the great masters of Greek art had been known to us; but here, on the 8th of May, 1877, the Germans unearthed an original statue by the hands of Praxiteles himself, the god Hermes bearing upon his arm the infant Dionysus, the god of wine. Finer statues the Greeks may have possessed, but the exquisite finish of the marble, the graceful lines of the composition, and the idealized beauty of the head, with its pure Greek profile, make this statue for us the most perfect example of Greek art, and it forms a fitting close for our pilgrimage to the shrines of ancient Hellas.

NOTES ON CLIMATOLOGY.

BY

ROBERT DeC. WARD.

Atlas of Meteorology.—The most important publication within the field of meteorology and climatology issued since the date of the "Challenger" *Report on Atmospheric Circulation* is certainly the new *Atlas of Meteorology*, prepared by J. G. Bartholomew and A. J. Herbertson, and edited by Dr. Alexander Buchan. This *Atlas of Meteorology* is Vol. III of Bartholomew's new Physical Atlas, and bears the date 1899. In 1887, twelve years ago, there was published an *Atlas der Meteorologie*, which formed a part of Berghaus' *Physikalischer Atlas*, and was prepared by Dr. Julius Hann, of Vienna. In Dr. Hann's atlas existing meteorological knowledge was summarized graphically on twelve plates, containing nearly sixty maps. The Berghaus atlas was superseded, so far as charts of temperature, pressure and winds were concerned, by the "Challenger" isothermal and isobaric charts, which embodied all the data available at the time of their publication. These "Challenger" charts have themselves had but limited use, because of their relatively high cost; but they have been reproduced on a small scale in several of the newer text-books of meteorology, and have thus become familiar to large numbers of persons.

The publication of the "Challenger" isothermal and isobaric charts, however, did not suffice to supply the need that has been increasingly felt during the last few years for a new atlas of meteorology, which should present all the latest information available for all parts of the world, and which should include not only charts of mean annual and mean monthly temperatures and pressures, but also charts of temperature ranges and anomalies; of rainfall, cloudiness, sunshine, etc. Bartholomew's new *Atlas of Meteorology* supplies this need fully, in every respect. Hann's atlas of 1887 contained, as has been stated, about sixty maps. This new Atlas contains over four hundred, all of them admirable examples of the highest development of present cartographic methods. In the preparation of this Atlas Messrs. Bartholomew and Herbertson have had the constant advice and assistance of Dr. Buchan, and have also been effectively aided by Drs. Hann, van Bebber, Köppen, Angot, and Messrs. Willis L. Moore, and John Eliot, and the late Mr. G. J. Symons. In fact the Atlas, as it stands, represents, in the phrase of the preface, "the position of meteorology at the close of the nineteenth century." The labor involved in the preparation of the charts must have been enormous, for the data used as the basis for them had to be collected from the publications of many countries. The bulk of this work has been done by Dr. Herbertson, who is entitled to the highest praise for the able manner in which he has handled this material.

The thirty-four plates of the Atlas are arranged so as to fall under two heads—Climate and Weather. Under the former heading come the mean annual and mean monthly isothermal charts for the world, and for certain special countries, such as Europe, the United States, and India; the mean annual and the mean monthly isobaric and wind charts; the charts of sunshine, cloudiness, rainfall, etc. Under the second heading, Weather, there are charts showing the conditions under which typical and anomalous weather occurs in different countries. The pressures which prevail in abnormally hot or cold seasons and months in various countries, and which produce certain types of weather or certain kinds of winds, storm tracks and storm frequencies in different parts of the world,—these and other subjects are charted among the maps illustrating the general subject of weather. It is impossible to do this Atlas justice in a brief note. Recognizing the limitations of the work, as to size and number of maps, it seems to us impossible for anyone justly to utter a word of unfavorable criticism of the volume. Everything that anyone could wish for seems to us to be included. Both English and metric systems are used on the pressure and rainfall charts, and both Fahrenheit and Centigrade degrees are given on the temperature charts. The scheme of coloring is admirably adapted to bringing out the facts with the greatest clearness. If we were asked to name the two most important features of this new Atlas, we should say that they are as follows:—First, the charts showing the mean rainfall for the whole world for every month of the year. Second, the emphasis which is laid upon the weather types, normal and abnormal, of which climate is made up. Climate has too long been a dead mass of averages. The individual weather types which go to make up these averages have been hitherto almost wholly disregarded. The *Atlas of Meteorology* is certain to be welcomed not by meteorologists only, but by all men of science. It is one of the most notable scientific publications issued in many years.

THE CLIMATIC ZONES OF SIBERIA.—An article by J. Y. Simpson, entitled *The New Siberia*, in the *Scottish Geographical Magazine* for January, lays emphasis upon the climatic zones of Siberia and the relations of these zones to human occupation. The country may be divided into three broad east and west zones. The tundra comes furthest north; then the taiga or belt of virgin forest, and lastly the more open zone to the south, which is largely agricultural. Between this last zone and the southern frontier come further the steppe region and the Russian slopes of the Altai and Sayan Mountains. In the tundra the subsoil is always frozen, the surface is a swamp in summer, where lichen and moss alone can grow. The climatic difficulty in the case of the tundra zone

> does not lie in the small number of degrees of heat registered in summer . . . but in the relative shortness of the summer that succeeds the long winter, and in the great extremes that are reached within so brief a period. Hence, it is not easy to imagine how—unless in the event of such circumstances as have lately made Klondike appear to many to be a desirable place of residence—this tundra zone will ever be of service to the Russian Empire, or support a population other than that of the scant subarctic tribes to whom its wastes are home.

The belt of virgin forest overlaps the tundra on the south, and is the largest of the three zones, occupying almost half of Siberia. The climate is somewhat less rigorous than on the tundra,

> but agriculture is almost entirely impracticable unless with enormous trouble in certain well-favoured clearings. For the rest, it is an interminable maze of Siberian poplar, spruce, larch, cedar, fir, and pitch pine, with a dense undergrowth, a place of gloom below and silent conflict in mid-air. From the south, however, this forest belt is being slowly attacked with hatchets, and, as it were, pushed farther north, so that one day the land will support many more than the 700,000 Russians and natives who at present are resident within it.

South of this forest belt comes the more open, agricultural zone, in which cereals can be grown. Here the summer is longer, and here the Trans-Siberian Railway is destined to work a revolution by bringing in hundreds of thousands of Russian peasants to till the soil, which is often very rich,—so rich indeed in many places that thirty to forty crops may be gathered without giving any long interval for the repose of the ground.

OSCILLATIONS OF CLIMATE AND THE QUALITY OF THE GRAPE CROP.—*Ciel et Terre* for March 1 notes that the association of German vine-growers has published detailed tables concerning the quality of the wine produced between the years 1820 and 1895. It appears that the quality of the wine is closely related to the temporary fluctuations of climate. During dry and hot periods, corresponding to the years about 1830 and 1860, the wine obtained from all the German vineyards was, as a rule, superior to that obtained during the years about 1850 and 1880. Since the last-named year the average quality of the wine has noticeably improved. In all the grape-growing districts the curves of these two variables maintain a parallelism. The fact is, therefore, a striking confirmation of the oscillations of climate.

NOTES ON ANTHROPOLOGY.

BY

ROLAND B. DIXON.

CENTRAL ASIA.—In the *Revue Scientifique* (4th Ser. I. XIII; Nos. 6 and 7), under the title "Les peuplades retrouvées de l'Asie Centrale," M. Saint Yves sums up with admirable clearness the recent progress in unravelling the intricate history of Central Asia. Until within the last ten or fifteen years almost our sole guides in this labyrinth, in which migration followed migration, were the Chinese historiographers, on whose accuracy it was difficult to know how much to depend. With the great activity in exploration which has characterised this region during the last few years a great mass of material in the way of inscriptions, coins, and archæological remains has been brought to light, and with the help of this many questions have been solved. The successive invasions of Central Asia by nomadic hordes coming from Siberia; the resistance offered to their southward advance by the great block of the Chinese Empire; and the consequent spreading of the invaders eastward to Manchuria and westward and southwestward to Turkistan, India, Transcaspia and Europe—all this is made clear by the recent investigations. The period between the sixth and seventh centuries was that in which all three of the great religions—Buddhism, Islam, and Christianity (in its Nestorian form)—began their struggle in Asia, and first began to press forward into the heart of the continent. Of their mutual interaction and conflicts the inscriptions give ample evidence, and point unmistakably to the wide spread of Nestorianism. With the evidence afforded by these inscriptions, the ruins of monasteries and the cemeteries, we can the easier understand the foothold which Nestorianism gained in China itself. One fact of great interest is brought out by all these finds, and that is that in the main the Chinese historians were correct in their statements. We may hope, then, that with further investigation in the field, and with a thorough search of the immense mass of Chinese literature, eventually the veil may be lifted from a region which for ages has been the abode of mystery.

SMITH SOUND ESKIMO.—When in 1897 Lieut. R. E. Peary brought to New York a party of six Eskimos from Smith Sound, the opportunity of studying individuals of this isolated tribe was not to be neglected. The work was undertaken by Mr. A. L. Kroeber, the result of whose investigations has recently been published in the Bulletin of the American Museum of Natural History (XII; pp. 265–327).

Living on the north-west coast of Greenland between 76° and 78° 18′ N. Lat., and separated from their neighbors to the south by the uninhabited region of Melville Bay, these Eskimos have been practically isolated from all contact with the outside world. Intercourse across Smith Sound with the Central Eskimos of Ellesmere Land would seem to have occurred long ago to a very slight extent, but to have ceased for a considerable period—long enough for the Smith Sound Eskimos to forget the construction and use of the kayak and bow. In numbers the tribe seems to be almost holding its own, as its numbers are about the same in the various censuses which were taken by Peary. Curiously, the men are greatly in excess of the women—a situation very unusual among the Eskimos.

A very interesting and full account of the customs and mode of life and religion of the tribe is given, in which all available information from the earlier Arctic explorers in this region has been incorporated. As a result of his study of these Eskimos, Mr. Kroeber is led to the conclusion that they are more closely allied to the Greenland Eskimos than to the Central Eskimos, as has formerly been the opinion. The Smith Sound tribe stands geographically and ethnologically almost between the two. The theory that the Angmagsalingmiut, or East Greenlanders, reached their present habitat, not by way of west and south Greenland, but by the way of the desolate northern and eastern shores, seems to be disproved. If this had been the route followed, it would be expected that the Angmagsalingmiut would show many points of close relationship to the Smith Sound Eskimos. This is not the case, however, and it seems highly probable therefore that

> "the chain of ethnic relationship (and apparently the line of migration also) of the Eastern Eskimo is: Central Region, Smith Sound, West Greenland, East Greenland."

THE WYANDOTS.—In the *Archæological Report* (Ontario) for 1899 (Toronto, 1900, pp. 92–123), Mr. W. E. Connelly gives the results of many years' work among the Wyandots, dealing chiefly with their migrations and clan organisation. From their myths and legends he determines their original habitat as in the area lying between James Bay and the Labrador coast, north of the St. Lawrence. From here they went first south to the Great Lakes, and then settled on the northern bank of the St. Lawrence, opposite the Senecas. A severe conflict with the latter led the Wyandots to remove along the south side of Lake Ontario to Niagara, Toronto, and finally to the region west of the Hurons, with whom they formed a league against the gradually increasing power of the Iroquois. Quite a full account of the clan system of the Wyandots is given, in which twelve clans are recognised. It is stated that there are traditions pointing to the fact that the Wyandots were accompanied throughout a part of their migrations by the Delawares (an Algonkin people). This is of considerable interest, as the home of the Algonkin stock is supposed to be in much the same region as that of the Iroquoian (of whom the Wyandots are a branch), and intimate relations must have existed between the two stocks.

MIGRATIONS OF THE ETHIOPIANS.—The Foulas, Foules, Peul, etc., as they are variously called, a West African people sharply distinguished from the negroes, have for some time been considered to be of East African origin and closely related to the Abyssinians or Ethiopians. In *L'Anthropologie* (Vol. X., pp. 641–662), Dr. R. Verneau discusses this theory at some length and from recent material from the two regions in question, and from intervening areas, shows quite conclusively, it seems, that the theory is true. The specific characters of the Abyssinians are found, with more or less admixture of negro traits, practically throughout the whole region which lies between Abyssinia and the easternmost extension of the Foules or Peuls. There has evidently, therefore, been a migration of the Abyssinian stock from east to west along the border of the Sahara and between it and the equatorial forests. The date of this migration is roughly placed in the XVth century.

NOTES ON GEOGRAPHICAL EDUCATION.

BY

RICHARD E. DODGE.

Physiography as a College Entrance Subject.—The science of physiography, or, as it perhaps may better be called, physical geography, will undoubtedly be greatly strengthened in its position in the near future through its being made an optional entrance subject in certain of our leading universities. The effect of this action will be not only to give physiography a position as dignified as that of physics or chemistry, but to encourage the teaching of the subject in all the better secondary and college preparatory schools of the country. This step further testifies to the fact that this somewhat composite science is as capable of giving efficient mental discipline and scientific training as the other sciences that have so long held their position, practically unchallenged, in the secondary schools. Harvard and Columbia Universities have both raised this subject to the rank of a college entrance option. In the case of Harvard, physiography may count one point of the required minimum of two points in science out of the total twenty-six points which a candidate must pass for admission, according to the new method. The subject may be offered also under practically the same conditions as an option for entrance into the Lawrence Scientific School, of Harvard University.

In the case of Columbia, however, the subject takes perhaps a still more important position, inasmuch as it may count for one point out of fifteen required points, of which not more than two can be in elementary science.

Inasmuch as in both these instances the requirement is much higher than can be attained by a pupil pursuing the subject in the first or second year of his secondary course, this means the inclusion of an elective in physiography in the later years of the courses of all those schools that desire to fit their pupils in all subjects for these universities. It is hoped that in the course of time the influence of secondary schools will have been so extended downward that geography teaching in the elementary school will have reached such a standard that pupils will not have to wait until their high school course for an insight into the physical features of the earth, causally considered. Under the existing conditions, the consensus of opinion is that physical geography must occur in the first or second year of the secondary school course, and the latest and best recommendations of experts emphasize this point very strongly.

SUMMER SCHOOLS IN PHYSICAL GEOGRAPHY.—The demand of progressive teachers for summer opportunities for studying rational geography points, perhaps more strongly than any other fact, to the slow improvement of geography teaching that is coming about in the elementary schools, in answer to the continued endeavors of leaders in the subject during the last ten years. Practically every summer school or institute of any strength or size includes at the present time in its curriculum courses of greater or less length and completeness in geography.

It is in the leading universities, however, that the subject of geography receives the most concentrated and scientific attention, and progressive teachers can find the most serious help along the line of modern geography during their summer vacation. The University of Chicago, Columbia University, Cornell University and Harvard University will, during the coming summer, offer rich opportunities to teachers who desire to study special phases of geography. It should be noted, however, that in the University of Chicago the courses to be given are not a part of a special summer school, arranged for the needs of teachers, but the regular work of the summer quarter of the university, to which teachers are eligible. As a matter of fact, however, the courses in the other institutions noted are as nearly as possible the equivalents of certain parts of regular term courses. Possibilities for teachers are perhaps indicated by the following lists of courses given at the different universities. At the University of Chicago we find announced courses running for six weeks, five times a week, in elementary meteorology; oceanography; physiography of land surfaces, with a special reference to the United States, and the physical evolution of the North American continent—an outline course for teachers of geology and geography. At Cornell University there are six-week courses in the geography of North America three times a week, and in physiography five times a week, these courses being especially arranged for teachers. At Harvard University a course is announced in geography running for six weeks, five days a week, and devoted largely to the study of land forms, meteorology, and oceanography. At Columbia University, two courses are announced, five weeks, six days a week—one in general geography and one in scientific physiography. In each of the universities the courses will be given with the full material equipment of the departments, and the effect on the two or three hundred students who will probably be attracted by the courses ought to be very great. Already the summer work of our universities along these lines has exerted a great influence upon the teaching of school geography, and it will not be many years before a large number of the teachers in our elementary schools will have been deeply influenced through such university work. It is to be hoped that other colleges and universities may feel the demands of the times and establish strong departments in geography in the near future.

AN EVIL THAT CALLS FOR CORRECTION.

Attention is invited to the following letter:

Incorporated 1851.
THE MASSACHUSETTS MUTUAL LIFE INSURANCE COMPANY,
SPRINGFIELD, MASS., April 4, 1900.

JOHN A. HALL, *President.*
HENRY S. LEE, *Vice-President.*
HENRY M. PHILLIPS, *Secretary.*
E. D. CAPRON, *Asst. Secretary.*
OSCAR B. IRELAND, *Actuary.*
H. W. HASKINS, *2d Asst. Secretary.*

A. A. RAVEN, Esq., Secretary,
American Geographical Society,
11 West 29th St., New York.

DEAR SIR:

I beg to ask whether it would not be in the province of your Society to remonstrate against a practice in map-making that seems to me quite likely seriously to mislead the young and others in search of information about the geography of our own country. I refer to the practice of publishing maps of the United States in which different scales are used for different parts of the map, without any explanation or obvious line of separation, the two scales in fact being sometimes used in the same part of the same map. The Chicago, Burlington & Quincy Railroad some time ago issued a map, engraved by Rand, McNally & Co., of this character. Taking the distance from Boston to Chicago as a standard, the distance from San Francisco to Denver is shown in reliable maps to be about 1.12 of this standard distance. On the map just referred to it is only about .9 of the standard distance, or 80 per cent. of what it should be. The distance from New Orleans to Duluth is shown on correct maps to be about 1.36 of the distance from Boston to Chicago; on the C. B. & Q. map it is about 1.25, or about 92 per cent. of what it should be. The ratio of the length of the southern side of Colorado to the length of its eastern boundary is really about 1.39; on the C. B. & Q. map it is about 1.21, or about 87 per cent. of what it should be. This map is mounted on rollers and got up in such a manner as to adapt it to use as a wall map, and is quite good enough in general execution to be preserved for reference.

More recently the New York Central Railroad has issued a map, prepared by the Matthews-Northrup Company, in which the distance from San Francisco to Denver is .64 of the distance from Boston to Chicago, or 57 per cent. of what it should be. The distance from New Orleans to Duluth is 1.04 of the standard distance, or about 76 per cent. of what it should be, and the State of Colorado is almost exactly a square, making the length of southern boundary 72 per cent. of what it should be in comparison with the length of the eastern side. This map is issued as a folder, and is finished in very attractive style. It is quite likely to be preserved, and quite good enough in general style to be fastened on a wall for study.

Of course cheap sketches of railroad routes are not expected to be accurate as maps, but when our wealthiest corporations issue in large quantities maps of this kind, prepared by the leading map-makers of the country, it seems to me that they are likely to do a good deal in the way of instilling ideas that must be afterwards unlearned, if one is to get at the truth, and that a protest from the American Geographical Society would be quite in order, and might be of some effect.

I remain,
Yours respectfully,
OSCAR B. IRELAND.

GEOGRAPHICAL RECORD.

AMERICA.

SHRINKAGE OF GREAT SALT LAKE.—The level of Great Salt Lake is reported to be steadily falling on account of the large volume of water, tributary to it, which is now absorbed by irrigation enterprises. The Jordan and Bear rivers, City Creek and other tributaries rise in the mountains to the east and, before they were intercepted by irrigation ditches, poured into the lake, the year round, about 10,000 cubic feet a second. The evaporation from the lake surface is very large, and the diminution in the supply is lowering the lake level. It is interesting to learn (*Deutsche Rundschau für Geographie und Statistik*, Jan., 1900) that a similar condition now exists in the Dead Sea, Palestine. That sea was formerly much larger than at present, as is shown by the old beaches, stretching at various altitudes along the basin. Since the middle of the century its level has been very slowly rising till quite recently, but now it is falling. This is due, not to natural causes, but to the increasing quantity of water taken from the Jordan and smaller streams by farmers, who are diverting all the water they can get to their lands. Some of the salt deposits covering the bottom of the lake may now be seen above the water in the shallower places and near the shores. But even though this desiccation should go steadily on it would take a long time to dry up the waters, for the lake is over 1,300 feet deep in the northern part of the basin.

DREDGING GOLD FROM THE SEA.—A number of companies and individuals are preparing to dredge for gold in the sea off Cape Nome, Alaska. This is a new phase of gold mining, and the result of the novel conditions under which gold is found in the Cape Nome region. The gold came originally from the quartz veins in the mountains of limestone and mica schist, from four to five miles inland. In the course of denudation a great deal of this gold-bearing quartz has been gradually carried by water agency down the gentle but continuous slope from the mountains to the sea. Mining was carried on last year along the beach sands for a distance of thirty miles, the gold being found in fine particles from two to five feet below the sand surface. It is also found, under similar conditions, beneath the sea for a considerable distance from the shore, and dredging is possible because of the shallowness of the water for some distance from the beach.

THE TOCANTINS RIVER.—*Le Mouvement Géographique* says that writers on geography are only just beginning to treat the Tocantins river of South America as an independent hydrographic basin. It should be added, however, that some of the latest geographical works still treat the Tocantins as a part of the Amazon system. A geography recently published in England, for example, says that "The Tocantins form a part of the Amazon system, being only divided from it by some islands." A British school geography, published last year, gives the area of the Amazon basin, and includes the Tocantins in it. Most of the French geographers, likewise, make the Tocantins a part of the Amazon system. M. Reclus, in his description of the Tocantins in the "Universal Geography," several years ago, treated the system as a distinct basin, and was one of the first geographical writers to give the correct idea of it. The river rises far to the south, has a tributary, the Araguaya, which is even larger than the Tocantins, and the joint streams form one of the great rivers of the continent, with a width, for a long distance, of two or three miles; but the river is so impeded by rapids that it is scarcely available for navigation until it widens into the great estuary on which Pará stands. It reaches the Atlantic about forty miles east of the nearest delta branch of the Amazon. Some water from the Amazon enters the Tocantins through several narrow arms of the Amazon delta; but this fact does not make the two rivers a part of the same system any more than the Cassiquiare, which unites the Orinoco and the Rio Negro, makes the Amazon and the Orinoco one hydrographic system.

NAVIGATION OF THE BERMEJO RIVER.—The *Boletin del Instituto Geogr. Argentino* gives some description of the journey of the Messrs. Leach down the San Francisco and Bermejo rivers across the Gran Chaco of Argentina. These two gentlemen are among the most energetic promoters of industrial enterprises in the mountainous province of Jujuy. The San Francisco is part of the Rio Grande del Jujuy and empties into the Bermejo. The explorers had heard that the condition of these rivers had considerably changed and believed they might be found to be navigable. The Government supplied them with three boats specially built for their use, and on March 13 last year they started on their long journey. They found navigation difficult in the San Francisco, and it was a toilsome task dragging and pushing the boats and getting them afloat when they ran aground. In eight days, however, they reached the Bermejo. At the point where the Rio Teuco branches off from the Bermejo the bed of the latter stream became almost dry; but the Teuco had water of sufficient depth, and they had no trouble whatever in descending that river to the point where it rejoins the Bermejo and thence to the Paraguay river, 146 miles further east. The Messrs. Leach believe that they have fully demonstrated the availability of the Bermejo route to the Paraguay as an outlet for the products of Jujuy. No report so favorable as to the navigability of the Bermejo was made by earlier explorers.

RIVER AND FLOOD SERVICE.—The report of the Chief of the Weather Bureau for 1899 says it is proposed, during the next two years, if sufficient funds are available, to prepare a comprehensive work on the entire navigable water régime of the United States, giving a complete history of all river stations, elevations above tide water, rate of flow of water and data for flood forecasting. No work of this character has yet been undertaken, though its importance has long been recognized. According to the *Deutsche Rundschau für Geographie und Statistik* (Nov., 1899), the system of water forecasts in Austria-Hungary is somewhat similar to that in this country. In the Ministry of the Interior is a Hydrographic Division, with many stations in different localities, whose object is the study of all the rivers in the country and observations relating to precipitation and the height of river waters. The stage of water in all the rivers is reported daily, the observations being made at 8 A. M., and from these data forecasts for the following twenty-four hours are deduced and telegraphed to the Government.

EUROPE.

EUROPEAN EMIGRATION IN THE NINETEENTH CENTURY.—According to an article in *Globus* (No. 24, 1899), about 30,000,000 persons left Europe during the century just closing to seek to better their fortunes in other lands. Up to 1820 only about 250,000 Europeans removed to the Americas, but between 1820 and 1882 more than 17,000,000 Europeans left their homes for the New World. The high tide of European exodus was reached in 1882, when the United States alone received 800,000 immigrants. The two next greatest years in this movement of population were 1888 and 1892, when this country saw 1,140,000 Europeans enter its ports. Between 1882 and 1893 the European outpouring to various marts of the world was over 9,000,000 souls. In the six years ending in

1899 about 3,000,000 Europeans sailed for foreign lands. The world never saw before anything comparable with this tremendous movement of people in so short a space of time as one century The populaticn Europe has thus lost by emigration in a hundred years is greater than the total number of inhabitants of Great Britain and Ireland in 1860.

NOVOROSSIYSK FREEZES OVER.—In 1888 the Russians reopened the port of Novorossiysk, on the northeast side of the Black Sea. It has had very rapid development, has become a large wheat shipping port, and its population is now over 35,000. It exported only 46,000 tons of freight in the first year of business; while its exports in 1896, chiefly wheat, amounted to 767,000 tons. Its great recommendation was that its harbor was free from ice the year round. The port, however, froze over in December last, when none of the strongest vessels were able to reach the docks. The shipping business was practically suspended till a thaw came. The Russians, after all, cannot claim any Black Sea port to be unimpeded by ice in winter except Batum.

AFRICA.

PROGRESS IN MADAGASCAR.—*Petermanns Mitteilungen* (III, 1900) reports that General Gallieni is making excellent progress with the geographic and cartographic work began in 1897. His efforts are mainly directed in making a good map of Madagascar. Before the French took possession only the central province of Imerina had been trigonometrically surveyed. The map sheets now completed include 12 sheets on the comparatively large scale of 1:100,000; 3 sheets in 1:500,000, and a one-sheet map of the entire island in 1:2,500,000. The map on the largest scale, 1:100,000, will at present be completed only for the central province, the east coast region and Diego Suarez. When the map of the whole island on this scale is completed it will number 508 sheets. The triangulation thus far carried out has called attention to many errors in the position of places shown on earlier maps. It is gratifying to observe that such excellent progress is making in the mapping of Madagascar, the fourth largest island in the world. The French are making important progress in Madagascar, and the island is sure to have large commercial development. The canals, about one and four-sevenths miles long, which are being cut through the hills that separate the lagoons bordering the sea between Tamatave and Andovoranto, sixty miles south, will be completed this summer (*Revue Française* *de l'Etranger et des Colonies*, Feb., 1900). This will give a waterway for passengers and freight extending one-third of the distance on the regular caravan route between Tamatave and Antananarivo, the capital. Thirty miles of this water route were opened for business on May 15 last year, and up to November 1 more than 8,000 passengers were carried, and an average of 30 tons of merchandise was transported daily. The canal will not interfere with the projected railroad from Tamatave to Antananarivo, which, however, will not be built immediately. *Le Génie Civil* says that the wagon road between Tamatave and the capital, to supplant the miserable path that caravans have followed for generations, is now about two-thirds completed, and that the other important wagon road from the capital to Majunga, the chief west coast port, has been completed.

THE TELEPHONE ON THE CONGO.—*Le Mouvement Géographique* (No. 7, 1900) says that Boma, the capital of the Congo Free State, fifty miles from the mouth of the river, has been placed in telephonic communication with Kwamouth, 450 miles up the river. As the electric current was not sufficiently strong to carry messages direct from Boma, the town of Tumba, 180 miles distant, was made an intermediate station. The operator there telephones the message to Kwamouth, 270 miles, and in a very few minutes several sentences are thus transmitted between the lower and upper Congo. The extension of the telegraph and telephone service on the Congo is doing a great deal to facilitate business. The commerce of that region is having a large development since the completion of the railroad between Matadi and Stanley Pool nearly two years ago. Last year about 700,000 pounds of ivory, collected by steamers on the upper Congo, were carried down on the railroad and sent to the Antwerp market. Rubber is now gathered at much greater profit, since it no longer has to bear the heavy charge of transportation for 235 miles on the shoulders of porters. In 1887 the amount of rubber collected in the Congo basin was 30 tons, valued at $23,000. In 1899 the rubber collected in the Congo forests amounted to 3,300 tons, the export value of which was $9,900,000. The new railroad is also helping the development of navigation on the upper Congo and is stimulating other railroad enterprises. A railroad is now building north from Boma into the French territory of Majumba, which is rich in ivory and rubber and well adapted for large plantations. The road is to be 130 miles long, and the first thirty miles from Boma are now completed.

THE TELEGRAPH TO VICTORIA NYANZA.—The telegraph line from the Indian Ocean to Ripon Falls, where the White Nile leaves Victoria Nyanza, was completed in March. The cable does not yet touch at Mombasa, which is the sea end of the land line. Despatches from Victoria Nyanza must therefore be sent by steamer to be put on the cable at Zanzibar, which occasions a delay of several days. Five years ago, when the building of this line and the railroad alongside were begun, the shortest time in which news from the lake could reach Europe was about four months.

WESTERN MAURITANIA.—In November, 1898, Mr. Coppolani of the Algerian government was sent on a mission to the Moorish and Tuareg peoples, in the west part of the Saharan possessions of France, to establish friendly relations and study the development of Islam in this vast territory, which lies between Senegal and Morocco and forms the hinterland of the large Spanish territory of Rio de Oro. His mission was successfully accomplished. Very friendly relations were established with the people, and the region will hereafter be called Western Mauritania, and will be attached to the government of Algeria under the supervision of Mr. Coppolani. (*Le Tour du Monde*, No. 7, 1900.)

MISCELLANEOUS.

THE WEST AUSTRALIAN GOLD FIELDS.—Gold was not discovered in West Australia till 1885, and the fact that in fifteen years this region has become one of the greatest gold producers gives particular interest to the statistics from the *Scottish Geographical Magazine* (March, 1900) showing the present condition of the industry. The output of gold in 1890 was only 22,000 ounces, valued at $430,000. In 1898 it was 1,050,183 ounces, valued at $19,953,395. For the nine months ending Sept. 30, 1899, the output amounted to 1,160,000 ounces, valued at $22,000,000; and for the month of September alone it was 167,076 ounces, valued at $3,174,450, which was more than $80,000 over the best previous record.

TRAVELS OF THE JIGGER.—*Le Tour du Monde* says that the jigger, the small species of flea whose native home is tropical and subtropical America, and whose travels across Africa to Zanzibar were reported a few months ago, has arrived almost simultaneously in India and Madagascar. He was taken to Bombay by coolies returning from Africa. Letters from Nossi Bé, in northwest Madagascar, report his advent there and on the adjoining islands, where he is flourishing and multiplying in the sandy soil. All regions near or in the tropics seem destined to make his acquaintance.

POLAR REGIONS.

According to *Petermanns Mitteilungen*, No. 1, 1900, Dr. Otto Nordenskiöld will lead a Swedish South Polar expedition in July, 1901. His plan is to explore the lands to the south of America, and to establish a winter station on the South Shetland Islands, while his ship is to push as far to the south as possible in the summer of 1901–1902*, returning to the station before the setting in of winter.

The Exploring Steamer *Southern Cross*, with the Borchgrevink expedition sent out in August, 1898, by Sir George Newnes, arrived at Bluff Harbour, New Zealand, on the 1st April. Mr. Borchgrevink's telegram to Sir George reads:

> Object of expedition carried out. Furthest south with sledge; record, 78.50. Present position of South Magnetic Pole located. Zoologist Nicolai Hanson dead. *Southern Cross* safely at Stewart Island. Leaving for Hobart. All well.
>
> BORCHGREVINK.

Ross's highest latitude was 78° 10′ S. He assigned the position of the South Magnetic Pole to 75° 5′ and longitude 154° 8′ E. (*Voyage*, Vol. II, Appendix, No. X.)

It is announced that a Scottish expedition is to be organized to work in conjunction with the British and the German Antarctic expeditions. The sphere selected for exploration is the Weddell Sea quadrant, south of the Atlantic Ocean, while the British will explore to the south of the Pacific and the Germans to the south of the Indian Ocean.

The Scottish expedition is a private enterprise, under the charge of Mr. W. S. Bruce, who visited the Antarctic in 1892 and 1893, and has since made five voyages to the Arctic.

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* Perverse fate and the printer of the *Mitteilungen* send the ship on her way in 1891/92.

OCEANOGRAPHICAL NOTES.

BY

WILLIAM LIBBEY.

Observations on the Oceans.—The publication of observations upon the oceans is discussed by Dr. Köppen in the *Annalen der Hydrographie und Maritimen Meteorologie*, Heft V, 1899. After a carefully-prepared statement of the history of such publications he suggests three methods of procedure:

1. The publication of a portion of these observations in the form of synoptic tables or charts;

2. The publication of certain good "log books" *in extens o*;

3. The printing of short reports of voyages, from which could be derived:

a. The contents of the "log" for given times and places.

b. Some of the principal features of certain climatic zones.

These suggestions are followed by a series of applications showing how such materials could be utilized.

A large number of oceanographical works are reviewed in *Petermanns Mitteilungen*, Vol. 45, No. 5, 1899.

Professor Dr. Krümmel first takes up the chart of ocean currents produced last year by Dr. Gerhard Schott. Pointing out the fact that all such wall maps are behind the times, he calls attention to the fact that the construction of this chart makes it impossible for any one to follow its details at a greater distance than ten feet. Another criticism is based upon the idea that the draftsman seemed to think it necessary to construct a complete set of currents, and consequently drew curves and lines where it is a physical impossibility for currents to exist, as, for example, in the Pacific Ocean off the coast of New Zealand. This criticism is very well founded, as it is very desirable that only well-authenticated facts and observations should be embodied in charts of any sort. Inferences should be indicated in some way to carry the information that they are not based on observed facts. Professor Krümmel then points out some divergences between Dr. Schott's work in the Handbook of the Marine Observatory and in the wall map—notably in the limitations of the Brazil Current and the Agulhas Current, where it appears that the Handbook is more in accord with the state of our knowledge than the wall map. Another criticism is based upon the omission of the cold ice-bearing current west of Spitzbergen. The position of the Guinea Current in winter does not agree with the arrangement of the Isotherms, and the same is true in connection with the currents of the Gulf of Panama. These are, however, but isolated points in a map where there is much that is of a high character that is well worth careful study.

To the strictures upon the wall map, Dr. Schott replies in *Petermanns Mitteilungen*, Vol. 45, No. VII. He states that he prepared a map of currents, and not of temperature curves, and that the discrepancy between the map and the handbook is due to the necessity of having text and map in accord. He cites numerous authorities for his position as against Professor Krümmel.

Dr. Krümmel also reviews the article of M. J. Thoulet in the *Bulletin* of the Paris Geographical Society, Vol. 18, 1897, pp. 5-33.

This paper relates particularly to the sedimentary deposits on the coasts of France.

Thoulet thinks rightly that the shallow waters of the coast are of interest not only to the geologist, but to the navigator, the fisherman, the cable engineer, and also that they may prove useful in a practical way, since phosphates may eventually be obtained from this source. He criticises the German Fisheries maps because they appear only in black and white; whereas he believes shades of color would be better.

Dr. Krümmel points out the difficulty of using such finely colored maps on board a vessel when all is wet and the touch of a single dirty finger will damage or destroy their usefulness.

Thoulet gives directions for the preservation of specimens by drying them upon a plate and then putting them in a bottle with a paper bearing the locality and date. A clear classification is given of these sediments, based upon their mineralogical character and the size of the grains. The latter point is determined by the use of gauze sieves until nothing but the amorphous components are left behind, *i. e.*, such as cannot be determined to be mineral in composition by the microscope, and will not deposit more than 10 per cent. after standing for 40 minutes. Their composition is to be determined chemically as to whether they are limestone or clay.

The transition from sandy to clay bottom it is proposed to classify under four heads:

1, *Sand*, where up to 10 per cent. of clay is present; 2, *muddy sand*, where 10-30 per cent. of clay is found; 3, *sandy mud*, containing 60 per cent. of clay; and 4, *mud*, where there is from 60–100 per cent. of clay.

A color scheme is proposed which is well considered, and the criticism that the transitions are too gradual to be traced is met by the well-founded assertion that there are definite boundaries in nature which can be located. Thoulet proposes to interest a wide circle of amateurs in this work, in the way of gathering material, the specimens to be sent to some central station for analysis and classification. This would be a fitting sequel to the work of Delesse upon the *Lithologie du fond des mers*, and could appropriately be carried out by France in commemoration of the labors of that eminent student.

The third of Professor Krümmel's reviews deals with the discussion of the results obtained by means of the "Flaschenposten" of the German Marine Observatory. (*Archiv der Deutschen Seewarte*, Vol. XX, No. 2.) The courses taken by 643 bottles are discussed; 452 from the North Atlantic, 102 from the South Atlantic, 43 from the Indian, and 46 from the Pacific Ocean. It appears from a large number of similar observations that it makes very little difference whether the bottles are weighted with sand or not. It does not appear from the discussion what percentage of the bottles put in the water was heard from, but, judging from the results obtained by the Prince of Monaco, it can hardly be over eight or nine per cent.

Many valuable results were obtained by this means, however—as, for example, the course of the subdivisions of the Gulf Stream in the Bay of Biscay; the proof that there is no longer such a thing as the Rennell Current, already shown by the labors of the Prince of Monaco; the concentration of the currents of the tropical Atlantic toward the Caribbean Sea, where they form the centre of energy for the Gulf Stream, etc.

New light is also thrown upon the course of the currents southeast of the Cape Verde Islands. A confirmation of the theory that the earth's rotation plays a large part in the direction of these currents is readily obtained from the study of the curves in the high southern latitudes upon the chart.

It is important to note—though the fact is not new—that these currents, even when weak, are found contrary to the direction of the wind.

SECONDARY TIDAL UNDULATIONS.—In the *Transactions of the Royal Society of Canada* (Second Series, Vol. V, Sec. III, page 24), Mr. W. B. Dawson, C.E., presents an account of observations obtained by recording tide gauges in Nova Scotia. The localities chosen are Halifax, St. Paul Island, N. S., Yarmouth, N. S., and St. John, N. B. The progress in the tide is in the order of the places named, and its range increases in the same order.

It appears from the facsimile reproductions of the records that these secondary undulations are almost continuously present, although their range varies; the range being in the cases mentioned from an inch or two to four feet. In the case of Halifax this range is 33% of the range of the tide, at St. Paul 10%, at Yarmouth 45%, and at St. John, N. B., 11%. The undulations are most conspicuous on the traces at the times of high and low water.

No theory is advanced for these wavelets upon the tidal wave. It is, however, pointed out that they occur chiefly at times of storm disturbances. In any theory explaining the undulations a careful distinction should be drawn between their originating cause and their progress, as the examples given seem to indicate that the range of the undulations does not become magnified in the same ratio as the tidal undulation under the influence of the general features of the coast.

This problem has been taken up by Mr. Dawson in a region peculiarly fitted for such work, since the tides range from the highest in the world to a very flat tidal curve, which is almost inappreciable except at the spring; and only these secondary undulations are left in addition to the traces of storm disturbances. Records have now been secured at eight different stations, covering periods of from two to four years. The data thus obtained would almost seem to be sufficient to warrant some conclusions, but the Tidal Survey has so far not been able to take up the subject.

RELICS OF THE NARES EXPEDITION RECOVERED BY MR. PEARY.

Mr. Herbert L. Bridgman, Secretary of the Peary Arctic Club, sends the following account of the relics recovered by Mr. Peary in the summer of 1899 and forwarded by the Club in his name to the Museum of the Royal Naval College at Greenwich:

The Peary Arctic Club sends to-day (April 18) to the Museum of the Royal Naval College, at Greenwich, London, the mariner's sextant left at Repulse Harbor in 1876 by Lieut. (now Admiral) Beaumont during his heroic retreat; picked up and brought in eight years after by the late Lieut. James B. Lockwood, on his return from his memorable Farthest North expedition, and recovered from Fort Conger in May last by Civil Engineer Robert E. Peary on his sledge to his ice-bound *Windward* in Allman Bay, from which it was brought to Brooklyn by the *Diana*, the steamer of the Peary Arctic Club. With the sextant is also transmitted the original record deposited by Capt. (now Admiral) Sir George Nares in a cairn on Norman Lockyer Island, whence it was taken, last fall, by Mr. Peary, and transmitted with other dispatches and papers to the Club by the ship of last summer. The sextant, though exposed to the Arctic elements for eight years, is to-day in almost as good condition as new, perfectly serviceable, and with a little care would be restored to perfect condition. The mahogany case containing it, through the intense cold, is cracked along one side, but the instrument and its attachments are substantially in good working order. The sextant is one of the finest make and graduation, its eye-piece and other portions, which in use would come in contact with the person, being carefully protected by leather, so that the danger from contact with the intense cold would be avoided. The duplicate glass which accompanies the sextant is also in perfect condition, and altogether the instrument is remarkably little worse for wear after its almost thirty years' absence from the service to which it belonged.

Admiral Nares' record—on two large foolscap sheets, bearing the official heading of the Admiralty—is also in a remarkable state of preservation. The paper is as clear and spotless, the ink as black and perfectly legible, as on the day when deposited, proving the remarkable purity of the northern atmosphere, by which all moisture and consequent discoloration are completely avoided. The text of the Nares record is in full as follows:

ARCTIC EXPEDITION, H. M. S. ALERT, Sept. 7, 1876.

Her Majesty's ships Alert and Discovery arrived here on their way South toward Port Foulke. The Alert wintered in lat. 82 degrees 27 minutes N., long. 61 degrees 22 minutes W., inside grounded ice. The Discovery wintered in a sheltered harbour in lat. 81 degrees 44 minutes N., long. 65 degrees 3 minutes W. The sledge crews of the Alert, after a severe journey over the ice, succeeded in attaining lat. 83 degrees 20 minutes 30 seconds N.; and the coast line from the winter quarters of the Alert to the northward and westward was explored to 82 degrees 23 minutes N. long. 70 degrees 30 minutes W. Sledge parties from the Discovery explored the north coast of Greenland to lat. 82 degrees 21 minutes W., long. 52 minutes W. (approximately), a distance of seventy miles beyond Repulse Harbour. No land was sighted to the northward of the above explorations, except a few small islands at the extreme of the Greenland coast explored. Lady Franklin Sound was explored by the Discovery, and was found to run s. w. sixty-five miles and terminate in ten small bays; also, Petermann Fiord for nineteen miles, and was then found to be impassable for sledges, owing to glacial ice.

A seam of coal 23 feet thick was discovered in the neighbourhood of the Discovery's winter quarters.

Scurvy attacked nearly all the men employed in sledge travelling in both ships.

Four deaths have occurred. Belonging to H. M. ship Alert: Niels C. Petersen, interpreter, on the 14th of May, at winter quarters, from the effects of a severe frostbite, which necessitated a part of each foot being amputated, followed by exhaustion and scorbutic taint; George Porter, gunner, R. M. A., on the 8th of June, of scurvy and general debility, when absent on a sledging journey, and was buried in the floe in lat. 81 degrees 44 minutes N. H. M. S. Discovery: James J. Hand, A.B., on the 13th of June, Charles W. Paul, A.B., on the 29th of June, both of scurvy, and are buried in Polaris Bay.

The ice in the Polar Sea broke up on the 20th of July, and on the 31st the Alert left her winter quarters, and on the 12th of August rejoined the Discovery. Both ships left Discovery Bay on the 18th of August and proceeded South.

A boat and a depot of biscuit and stearin is left on the fiord point north of Cape Hawks.

G. S. Nares, Captain R. N.,
Commanding Expedition.

Both sextant and record were tendered to the Lords of the Admiralty by the Peary Arctic Club, in accordance with the suggestions of Mr. Peary, who transmitted them last summer, and the response was prompt and appreciative. The transmittal and presentation will be through Alfred C. Harmsworth, of the London "Daily Mail," an honorary member of the club, and giver of the *Windward* to Mr. Peary.

BOOK NOTICES.

A Forgotten Historical Landmark.—(*Byzantine Constantinople: the Walls of the City, and adjoining Historical Sites, by Alexander Van Millingen, Professor of History, Robert College, Constantinople. pp. xi and 361, with maps and illustrations; London, John Murray.*)

Utter degradation caused the fall of the Eastern Empire before the attacks of the Ottoman Turks. The ordinary reader remembers this degradation and turns his attention to less stagnant portions of the stream of history. Yet Constantinople was of unique importance in the world's history during a long period before its conquest by the Turks. It is a landmark of a struggle extending through ten centuries, which secured to Europe time for consolidation and for cultivation of intelligence and of power. It contains within itself to-day the buried relics of a heroic service to mankind. Its dilapidated walls strike the traveller as a fitting framework for the modern city, chiefly marvellous as a monument of neglected possibilities. Yet those walls represent the identical fortifications which stemmed the tide of more than one Asiatic invasion of European soil, and which caused repeated blows of the sword of Islam to fall harmlessly, as from impenetrable mail. During 900 years Islam clung to its hope of conquering all the world, and during eight hundred years of that time its chief obstacle was the sturdy Christian soldiers who manned the towers of that mighty encircling wall described in the book of Professor Van Millingen. To all appearance, without those walls as a barrier Europe would have been made Mohammedan territory before the tenth century.

The whole story of Constantinople abounds in interest to universal history. Demosthenes made the seizure of the ancient Byzantium the essential feature of one of his fervid appeals for the men of Athens to put bounds to the ambition of Philip of Macedon. When Constantine the Great selected the place as the site of his eastern capital, it was because he saw its tremendous importance to any man possessed by the ambitions of Imperialism. When Theodosius enlarged its limits and Justinian beautified its ecclesiastical establishments, they had appreciated its power of control over vast regions of Western Asia. Placed upon its hills at the point where the two continents approach each other from the east and from the west, and throwing its suburbs and its fortresses upon both shores of the narrow strait of the Bosporus, so that it actually stands upon two continents, this peerless city has within it the power of a controlling influence upon the destinies of a considerable part of both Europe and Asia. The study of what it has been we owe to our own understanding of the past and to our foresight of the future.

One of the features of life in Constantinople to-day is the extraordinary number of Asiatic peasants who annually come up to the city for work, and of Asiatic merchants who come there for trade. They stay in the city for four or five years or more, and then go back to their distant homes to enjoy the good things which they have gained. There is reason for believing that this has always been a characteristic of the city. Its population has been cosmopolitan, and, to a very great degree, mobile and floating. Probably not half of the present population of the city were born there. This fact explains the perpetual renewal of the influence of the city under all régimes, and it also explains some of the most surprising facts of its weakness, when war found it unable to man its walls satisfactorily, and when its military successes found no local Homers to immortalize them. So little is the interpretation of those old ruined walls known to the multitude, that Professor Van Millingen feels it necessary to explain and almost apologize for giving time to his minute examination of dusty records and dustier fragments of ruined structures. For at the very outset he explains that "the Empire, of which New Rome was the capital, defended the higher life of mankind against formidable antagonists, and rendered eminent service to the cause of human welfare. This is what gives to the archæological study of the city its dignity and importance."

His book is a manual for the archæologist bent on understanding as far as possible the various epochs of the city's growth, and on fixing the scenes of its historical episodes. The student of the archæology of the city is met at the outset by voluminous and often pretentious writings, which claim to fix every site of importance. As he reads more extensively he is entangled in a maze of contradictions found to exist between modern and even scholarly writers on the subject. And it is only upon resolutely entering into the study of the whole literature of Constantinople, as Prof. Van Millingen has done, that even the elements of the problem of the topography of Constantinople begin to loom out of the haze with any distinctness. This work of drudgery, which places the student in a position to judge the problems for himself, is one of the most notable and one of the most admirable features of "Byzantine Constantinople." Not only the historical writers have been called upon for testimony, but the ecclesiastical writers have been painfully examined for chance allusions to the neighborhood of their churches and their monasteries. Even the Bollandists, and their records of the saints of the church, have been compelled to add testimony for the solution of some intricate problems of the topography of the city, where some of the saints did their mighty works. The tireless thoroughness of this part of the work deserves all praise, while the abundant quotation of the actual words upon which important decisions depend fixes the value of every opinion of the author.

An example of this kind of study of authorities is found in Prof. Van Millingen's treatment of the question of the district of the Hebdomon. The Hebdomon (τὸ Ἕβδομον, "septimum") is mentioned in many accounts of great court functions of the Empire, and as a place of rendezvous for military expeditions before entering upon campaign. Here, too, the people were wont to resort both for pleasure and for refuge from earthquake and pestilence. The name occurs so frequently as to make the identification of the site quite important in attempts to reconstruct the scene. Yet the most part of modern writers on Constantinople follow Gyllius in his blundering supposition that this was the name of a place on the Theodosian walls. Prof. Van Millingen remarks that "of all the mistakes committed by students of the topography of Constantinople, none is so preposterous or inexcusable as this identification." The truth of this strong language is supported by conclusive quotations from Sozomen, Theophylactus Simocatta, Zosimus, Idatius, John of Antioch, Cedrenus, and others, and followed up by citations to show that the Hebdomon must have been upon the Sea of Marmora, and not upon the city wall. A survey of the requirements of the case then makes it easy to see, not only that the Hebdomon could not have been where the guide-book class of works unanimously place it, but that it could only have been in the vicinity of the village now known as Makrikeui, whose plains afford the necessary conveniences for military camps, and whose distance from the city agrees with the requirements of the name.

This clear and convincing method is followed with the question of the site of Constantine's walls, of the Harbors of the city, and of the sites of the various imperial palaces. All of the perplexing questions respecting the topography of Constantinople are not cleared up by this work. In fact, in regard to some of them one is tempted to sympathize with that famous Turkish judge who wished that he had not heard the testimony of the defendant, since "it tended to unsettle his mind." But in all of the questions treated a solid basis for a judgment has been established, which will quickly become conclusive as soon as a period arrives when some slight excavations can be made.

Among these unsettled questions which both baffle and stimulate enquiry is that of the Harbors of Constantinople and that of the Tower or Towers of Anemas, in the walls of the city. In modern times the great steamships of commerce find the harbor of Constantinople almost too narrow for their manœuvring. Its great depth alone saves it from the stigma of being incommodious. But in the days of the Byzantine Empire the masters of the little sailing craft, then representing maritime architecture, never dreamed that this place was a harbor. Byzantines always speak of it in their writings as "the Gulf" or "the Gulf of the Golden Horn," and describe as harbors small enclosures, where their fragile vessels might find shelter from the eddies and currents which sweep through all the waters of the city. The most of these little harbors have been successfully identified, and data for the others have been collected. The pick and shovel must do the rest.

As to the Towers of Anemas there is so much of romantic story connected with this place of political punishment that one could wish the result of investigation more conclusive. All that has been learned by the careful survey and study of the twin towers commonly called the Towers of Anemas, or the Tower of Isaac Angelus, and the Tower of Anemas, has been that the present structures are patchwork, which fit no one of the descriptions of the places under examination. Here, again, there must be an appeal to the pick for final proof.

This brings us to one of the difficulties of the study to which Prof. Van Millingen has given so many years of his time of recreation. Constantinople is a city of so great antiquity that its structures contain superimposed sections almost as diverse as those of the Troy of Schliemann. If the wall, or a tower of it fell, an emperor of some subsequent age hastened on the approach of danger to pick up all the convenient fragments and work them into a new form of the old work. During the time of the Greeks there may have been some attention to replacing the fallen slabs and inscriptions in their former places, and at least right side up. But after the Turks took the city they had no such sentimental ground for guiding the disposition of an inscription or a sculpture. Hence one is often bewildered by the appearance of inscriptions which would revolutionize the whole relations of a given site, if one could only be sure that they did not come from structures in quite a different locality. Other difficulties—which Prof. Van Millingen does not mention—are the suspicious nature of the authorities, who often hinder investigation through fear that the student is a seeker after hidden treasure revealed to him by his knowledge of ancient literature, and such physical hindrances as the great earthquake just alluded to on p. 150, when the author and his photographer were in the dark profundities of one of the ancient subterranean structures of the city wall at the time of the greatest earthquake experienced in Constantinople in two hundred years. There was no exit save by a passage thirty feet long, through which one had to wriggle on his stomach as best he could. In that noisome place those archæologists had to endure the full force of succeeding shocks, with all the noises of grinding walls and falling towers; noises magnified by the conducting power of the great mass of masonry over their heads. And when they did safely emerge into the light of day it was to see the whole atmosphere red with the dust of fallen ruins and to learn that hundreds of people had been killed in the city during those few terrible seconds.

This book is an archæological manual. But this does not signify that it is only this. Its identifications of sites give opportunity, which is admirably utilized, for interesting and readable memoranda upon the Byzantine court and its historical personages and their customs and relations. A set of maps and plans unique in their accuracy of detail, and a fine set of views of important parts of these old walls of Constantinople, add greatly to the value of the book to the student and the general reader.

H. O. D.

Morphologie des Tiën-schan, von Dr. Max Friederichsen. Mit einer Originalkarte. Sonder-Abdruck aus der Zeitschrift der Gesellschaft für Erdkunde zu Berlin, Band XXXIV, 1899.

This interesting monograph gives a comprehensive account of one of the great mountain systems of Central Asia. The author does not write from personal study of the region, but justifies his attempt on the ground of a rich but unappropriated Russian literature of the subject. The accompanying map is clear, and embodies a great variety of facts concerning the orography and hydrography of the region. Thus we have altitudes, as determined from one to three times by barometer, also by estimate. We find also the passes, with their altitudes, stream courses, explored and conjectural, and the high snow-fields. Routes of trade are shown, with settlements, areas of blown sand, and tracts below sea-level. Superimposed on this map we have upon transparent paper a chart of the lines of later exploration, from Semenov (1857) to Sven Hedin (1896).

The preface discusses the difficulty of writing modern geographic names. This is partly due to the fact that students of the earth are not familiar with linguistic knowledge. Here the difficulty is special, because the original Turko-Tartar or Chinese word is subject to a double transfer, first by a transcription into Russian sounds and characters, and, second, by bringing over these terms from Russian maps and accounts of travel into English, French and German works.

Our knowledge of the mountains of the interior of Asia is the fruit of researches of the naturalists of the century now closing. Reference is, however, made to the work of Pallas (1777), as introductory to the better results of Klaproth, Humboldt, Ritter, and especially of von Richthofen. The name Tian Shan is of Chinese origin, meaning Heaven's Mountains, and was at first applied only to the eastern Tian Shan of our modern maps, reaching perhaps not farther west than Khan-Tengri. Von Richthofen extended the use of the name, on the basis of common strike lines, over the Alai, Pamir and Hindu Kush. This study, however, does not include these groups, nor the Altai on the northeast, but comprehends the mountain mass lying between these limits, as constituting the proper Tian Shan. The surrounding desert and steppe regions are included so far as is needful for the understanding of the mountain system. Within these limits Dr. Friederichsen gives an analysis of horizontal distribution, of the altitudes and of the hydrographic, geologic, tectonic and climatic relations. The author aims at a morphology of the Tian Shan within the limits of Richthofen's law of scientific geography, as dealing with the surface of the earth itself, independent of its vesture and inhabitants, in a domain peculiarly its own.

A considerable section is occupied with a review of the sources of our knowledge. Here chief credit belongs to the Russians. Others, as the English, have usually only touched the borders of the region, or come up to the foot of the mountains. Russian research has developed with the growing influence of that Empire in China. Particular credit is given to Semenov, and, in language of peculiar interest to the physiographer of to-day. Originally a zoölogist, he had also a good knowledge of geology, and an *understanding for the dependence of surface form upon inner structure.* Thus his researches in Kara-ton, the Alexander mountains and the Naryn mountain land have real value, and he first recognized the two prevailing trends of the region. The maps are also, of course, chiefly a Russian product. Especial mention is made of the map of the Southern boundary of the Russian Empire, on a scale of 1:1,680,000, prepared under the direction of an officer of the War Department.

The Tian Shan lies between 40° and 46° N. lat. (that of north and middle Italy), and between 68° and 92° long. east from Greenwich. The greatest length of the system is about 1,956 km. (1,216 miles). This is more than twice the length of the Alpine system. Taking the principal trends of the Tian Shan we find some ranges on the northwest border of the system diverging in various measure from an east by west line toward the northwest. In the interior, both in the east and west, the prevailing lines are northeast by southwest. The parallel ranges are more numerous and are wider toward the west, but fewer and narrower on the east. To the converging of these two lines of strike is due the arrangement in gentle curves, concave to the north, which is seen on an inspection of the map.

Much is dependent upon these features. Thus the great rivers occupy longitudinal valleys. In the angle where two trends meet human settlement finds shelter. Through the broadening and diverging on the west, the mountains open themselves to commerce in that direction, while they stand wall-like on the east, as a barrier to trade. Thus these westerly-opening "compartments" have, in the later days, offered easy conquest to the colonizing, conquering spirit of the Russians. About these mountains extends a girdle of desert and steppe. The bases of the mountains inclose deep basins, filled with the deposits of parts of the Tertiary sea, as, for example, in the Aralo-Caspian basin. The surface is mantled and sharp contours are obscured by eolian masses of sand and dust. Thus we have also toward the Altai, the Dzungarian basin, and, on the south, toward Tibet, the Tarim basin. The eastern mountains disappear in the desert Shamo (Gobi), and the western go over into the Aralo-Caspian territory. The oasis border at the foot of the mountains is subject to the curse of this proximity. Step by step the destroying sands threaten the fruitful strips between the mountains and the desert.

The author disclaims any intention of presenting a scientific classification of the different groups of the Tian Shan, and cites the Alps, as showing how difficult this is, even for our best-known mountain systems. The chief feature of the horizontal arrangement has already been stated, viz., a departure from the east by west line, in two directions, though the N. E. by S. W. direction is the prevalent one. Coming to the vertical relations, there appears with great regularity as one advances from north to south a rise of absolute altitudes, with lessening of relative heights of mountains above the included valleys. Along the longitudinal axis the altitudes drop toward the east and toward the west, from the central portions of the system. A series of instructive tables shows the altitudes in metres, whether by barometer or by estimate, with the authority for the same. The largest water body within the field is Lake Balkhash, on the plains northward, at an altitude of 270 m. (886 feet.) The most northerly great range is the Dzungarian Ala-tau with heights of more than 3900 m. (12,850 feet). The snow line on the north slope is at 3050–3200 m. (10,060–10,550 feet). Semenov gives the following view of the zones of this range:

1.—Steppe zone, 160–480 m. (550–1600 feet).

2.—Culture zone, good tillage, 480–1300 m. (1600–4300 feet).

3.—Evergreen trees, 1300–2470 m. (4300–8130 feet).

4.—Alpine meadow zone, 2470–2900 m. (8130–9540 feet). Summer station of nomads.

5.—High Alpine zone, 2900–3640 m. (9540–11,995 feet).

6.—Eternal snow.

South and east of the above we find the Iren-khabirgan range, with great heights, 5000–6000 m. (16,460–19,740 feet); the Ili basin, 600–700 m. (1995–2325 feet); and the great Dzungarian basin, 230–700 m. (780–2325 feet). South of this basin is the Bogdo-ola, 4,000–6,000 m. (13,175–19,740 feet); and directly south of this we come upon the Turfan depression, marking levels of 50–70 m. (190–255 feet) *below sea-level.*

Turning to the west half of the Tian Shan system, we find the summits of the northern ranges having maximum altitudes of 4,200–4,800 m. (13,860–15,825 feet), the passes 1500–3000 m. (4950–9870 feet), or more, while the steppes at the foot of the mountains are 600–800 m. (2000–2650 feet) above sea-level. The grand culmination of the entire system is in its south central portion, the Khan-Tengri, with altitudes of 6000–7200 m. (19740–23700 feet). This is also an important centre of powerful and well-known glaciers.

The valleys now or formerly occupied by lakes range from 1615 m. (5300 feet) (Issyk-kul) and 1850 m. (6070 feet) (Kotchkar Basin) to 2873 m. (9426 feet) (Son-kul) and 3450 m. (11,319 feet) (Chatyr-kul).

The Tarim basin on the south of the Tian Shan is a high and large desert area—a most characteristic feature of Central Asia. A girdle of oasis runs along the watered base of the mountains. Far more favorable is the condition of the Ferghana valley on the west, with its flourishing settlements, and opening down by a gap in the mountains to the Aralo-Caspian depression.

There are two chief types of streams: (1) Those which extend east and west along lines of folding, in longitudinal valleys; (2) streams flowing across these lines, from the mountains down to the steppes and deserts and especially from the higher southerly to the lower northerly parts of the system. The drainage is continental—that is, all goes into inland seas, or disappears by evaporation or by infiltrations into the porous waste slopes bordering the mountains. Most of the great longitudinal streams enter these inland seas or lakes. The watersheds not seldom abandon the higher ranges and follow the lower. Watersheds of the second order, due to headward erosion, often separate two streams flowing in opposite directions in longitudinal valleys. Most of these longitudinal trunk streams are believed to occupy genuine synclinal valleys.

An interesting account is given of deposits in high valleys, believed by Richthofen to be of subaerial origin, but held by Semenov and others to be lake deposits. The author holds the former theory untenable in view of many explicit descriptions of the deposits as stratified, but admits the active cooperation of atmospheric agents.

Many of the transverse valleys are believed to have originated as outlet channels of ancient and elevated lakes. The outlet of Son-kul is cited as a present concrete case, and other probable examples are given. The space allotted to this review does not permit reference to the geological formations or to the interesting chapter on the climate and its effect on the morphology of the region.

A. P. B.

ACCESSIONS TO THE LIBRARY.

March–April, 1900.

BY PURCHASE.

Iceland, Its Volcanoes, Geysers and Glaciers, by Chas. S. Forbes, London, 1860, 8vo ; History of Long Island, by Benj. F. Thompson, New York, 1839, 8vo ; 'Twixt Greek and Turk, by M. Valentine Chirol, Edinburgh and London, 1881, 8vo ; A Voyago to Arabia the Happy, etc. (Jean de La Roque), London, 1720, 12mo ; Indianer und Anglo-Amerikaner, von Georg Friederici, Braunschweig, 1900, 8vo ; Palms and Pearls, or Scenes in Ceylon, by Alan Walters, London, 1892, 8vo ; Last Days of Knickerbocker Life in New York, by Abram C. Dayton, New York and London, 1897, 8vo ; Atlas von China (1te Abth.), Ferdinand Fr. von Richthofen, Berlin, 1885, folio ; Andrees Allgemeiner Handatlas (4te Auflage), A. Scobel und R. Andree, Bielefeld und Leipzig, 1899, folio; History of the Orkney Islands, by G. Barry, Edinburgh, 1805, 4to; The Evolution ot Geography, by John Keane, London, 1899, 8vo; In Moorish Captivity, by Henry M. Grey, London, 1899, 8vo; Byzantine Constantinople, by Alexander Van Millingen, London, 1899, 8vo; Historical Geography, of the Holy Land, by George Adam Smith, London, 1898, 8vo; Southern Arabia, by Theodore Bent and Mrs. Theodore Bent, London, 1900, 8vo ; Temperate Chile, by W. Anderson Smith, London, 1899, 8vo; A Short Memoir of Mohammed Ali, by Sir C. A. Murray, London, 1898, 8vo ; Behind an Eastern Veil, by C. J. Wills, New Edition, Edinburgh and London (1894), 8vo ; In the Land of the Lion and the Sun, by C. J. Wills, London, 1883, 8vo ; The Expansion of Egypt, by Arthur Silva White, London, 1899, 8vo; The Victoria Nyanza, by Paul Kollmann, London, 1899, 8vo ; Findlay's Directories of the Oceans, London, 1882–1895, 6 vols., 8vo ; The Lake Country, by E. Lynn Linton, London, 1864, 8vo ; Settlement and Early History of Albany, by William Barnes, Albany, 1864, 8vo ; Residence at the Court of London, 1819–1825, by Richard Rush, London, 1845, 8vo ; Cosas de España, by Mrs. Wm. Pitt Byrne, London, 1866, 2 vols., 8vo; A Visit to St. Petersburg, 1829–1830, by Thomas Raikes, London, 1838, 8vo; A Land Journey from Asia to Europe, by William Athenry Whyte, London, 1871, 8vo; Picturesque Sketches of Greece and Turkey, by Aubrey De Vere, London, 1850, 2 vols., 8vo ; The Eagle's Nest in the Valley of Sixt, by Alfred Wills, London, 1860, 8vo ; Summer and Winter in the Pyrenees (Mrs. Sarah S. Ellis), London (1841), 8vo ; An Historical and Descriptive Narrative of the Mammoth Cave of Kentucky, by W. Stump Forwood, Philadelphia, 1870, 8vo ; The Nooks and By Ways of Italy, by Craufurd Tait Ramage, Liverpool, 1868, 8vo; Minerva, Vol. IX, K. Trübner und F. Mentz, Strassburg, 1900, 8vo ; Modern Spain, 1788–1898, by Martin A. S. Hume, New York, 1900, 8vo ; Africa, Its Partition and Its Future, by H. M. Stanley and others, New York, 1898, 8vo ; Among the Matabele, by Rev. D. Carnegie, 2nd Edition, London, 1894, 8vo ; The Nicaragua Canal, by William E. Simmons, New York, 1900, 8vo ; The Transvaal Outlook, by Albert Stickney, New York, 1900, 8vo ; A Woman's Part in a Revolution, by Mrs. John Hays Hammond, New York, 1897, 16mo ; White Man's Africa, by Poultney Bigelow, New York, 1900, 8vo; The Story of the Boers, by C. W. Van der Hoogt, London, 1900, 8vo; The War in South Africa, by J. A. Hobson, New York, 1900, 8vo ; A Short History of British Colonial Policy, by H. E. Egerton, London, 1897, 8vo; The Transvaal from Within, by J. P. Fitzpatrick, New York, 1900, 8vo ; The Federal Census: Critical Essays by Members of the American

Economic Association, New York, 1899, 8vo; Alone Through Syria, by Ellen E. Miller, London, 1891, 8vo; Kars and Erzeroum: with Campaigns of 1828 and 1829, by Lieut.-Gen. W. Monteith, London, 1856, 8vo; Dictionary, Hindustani and English, by Duncan Forbes, 2d edition, London, 1862, 8vo; The Cape and the Kafirs, by Alfred W. Cole, Paris, 1852, 8vo; Charters and General Laws of the Colony and Province of Massachusetts Bay, Boston, 1814, 8vo; Account of a Tour in Normandy (Dawson Turner), London, 1820, 2 vols. 8vo; Negro Myths from the Georgia Coast, by C. C. Jones, Jr., Boston, 1888, 16mo; See-Helden: Leben und Thaten der, u. s. w., von V. D. B., Sulzbach (1686), 4to; The Annual American Catalogue, 1899 (English Catalogue added), edited by R. R. Bowker, New York, 1900, 8vo; The Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaites, Vols. LXIII–LXIV, Cleveland, 1900, 8vo; History of New Hampshire, from its First Discovery to the Year 1830, by E. D. Sanborn, Manchester, N. H., 1875, 8vo; Geological Survey of Michigan, 5 vols. 8vo and atlas folio, New York, 1873–1881, Lansing, 1895; The Key to South Africa, Delagoa Bay, by Montague George Jessett, London, 1899, 8vo; Dictionary of National Biography, edited by Sidney Lee, Vol. LXII, London, 1900, 8vo; Cities and Towns of China, by G. M. H. Playfair, Hong Kong, 1879, 8vo; Natural History Lore and Legend, by F. Edward Hulme, London, 1895, 8vo; A Marine Pocket Dictionary of the Italian, Spanish, Portuguese and German Languages, etc., by Henry Neuman, London, 1800, 8vo; The Annual Literary Index for 1899, W. I. Fletcher and R. R. Bowker, New York, 1900, 8vo; Une Femme chez les Sahariennes, par M^me^ Jean Pommerol, Paris (1900), 8vo; Notes sur l'Inde, par le Prince Bojidar Karageorgevitch, Paris (1900), 8vo; Letters Received by the East India Company from Its Servants in the East, 1602–1615, edited by W. Foster, London, 1896–1899, 3 vols. 8vo; Voyage dans le Nord du Brésil, 1613 et 1614, par le Père Yves d'Evreux, Leipzig and Paris, 1864, 8vo; Excavations at Carnac (Brittany), Researches at Kermario, by James Miln, Edinburgh, 1881, 8vo; British Empire Series: Vol. I, India, etc., Vol. II, British Africa, by various authors, London, 1899, 8vo; In Dwarf Land and Cannibal Country, by A. B. Lloyd, London, 1899, 8vo; Atti del Terzo Congresso Geografico Italiano (Volume Secondo), Aprile, 1898, Firenze, 1899, 8vo; Le Sahara Algérien, par le Lieut.-Col. (E.) Daumas, Paris, 1845, 8vo; A Classical Dictionary of India, by John Garrett, Madras, 1871, 8vo; From the Alps to the Andes, by Mattias Zurbriggen, London, 1899, 8vo; Le Brésil, par E. Levasseur, et autres, Paris, 1889, 4to; Biografías de Mexicanos Distinguidos, Francisco Sosa, Mexico, 1884, 8vo; New York, Past, Present and Future, etc., by E. Porter Belden, New York, 1849, 12mo; Visit to the Monastery of La Trappe, by W. D. Fellowes, London, 1823, 8vo; The Gold Mines of the Rand, by F. H. Hatch and J. A. Chalmers, London, 1895, 8vo; Our South African Empire, by William Greswell, London, 1885, 2 vols. 8vo; Yaman, Its Early Mediæval History, the Original Texts, with Translation and Notes by Henry Cassels Kay, London, 1892, 8vo; Catalogue of Maps, Plans and Views of London, etc., collected, etc., by Frederick Crace, London, 1878, 8vo; Sketches in Sunshine and Storm, by W. J. Knox Little, London, 1892, 8vo; Gazetteer of New Hampshire, by J. Farmer and J. B. Moore, Concord, 1823, 12mo; An Inquiry into the Origin of the Antiquities of America, by John Delafield, Jr., New York, 1839, 4to; The History of the First West India Regiment, by A. B. Ellis, London, 1885, 8vo; The New York Directory for 1786, by David Franks, New York, 1786, square 12mo (reprint, 1875); Six Mois dans l'Attié (Côte d' Ivoire), par Camille Dreyfus, Paris (1898), 12mo; La Rénovation de l'Asie, par Pierre Leroy-Beaulieu, Paris, 1900, 16mo; Java et ses habitants, par J. Chailley-Bert, Paris, 1900, 16mo; Life of Hernando Cortes, by Arthur Helps, London, 1871, 2 vols. 8vo; Life of Pizarro, by Arthur Helps, London, 1869, 2d Edition, 8vo; A

Journey Through Texas, by Frederick Law Olmsted, New York, 1857, 12mo; The Military and Civil History of the County of Essex, New York, by Winslow C. Watson, Albany, 1869, 8vo; A Russian Province of the North, by Alexander Platonovich Engelhardt, Westminster, 1899, 8vo; Sailing Alone Around the World, by Captain Joshua Slocum, New York, 1900, 8vo; Notes on Sport and Travel, by George Henry Kingsley, London, 1900, 8vo; Cities of Belgium, by Grant Allen, New York, 1900, 16mo; Venice, by Grant Allen, New York, 1900, 16mo; The Transvaal War, by J. Westlake, London, 1899, 8vo; The Story of Moscow, by Wirt Gerrare, London, 1900, 16mo; History of the Colonization of Africa, by Sir H. H. Johnston, Cambridge, 1899, 8vo.

GIFTS.

From W. Bell Dawson, Author :

Illustrations of Remarkable Secondary Tidal Undulations in January, 1899, as registered on Recording Tide Gauges in the Region of Nova Scotia. Extract from the Transactions of the Royal Society of Canada, Second Series, Vol. V, Section III. Toronto, 1899.

"*Donation through a Member from Friends*":

Atlas of Various States and Countries, principally by Morse and Bruce (various dates); Drawing of the ship Eureka; Sandwich Islands, Admiralty Chart, Sept. 6, 1843, London; Canton River, J. Horsburgh, July, 1831, corrected to June 4, 1847, London; Strait of Sunda, J. Horsburgh, June 4, 1813, corrected to 1845, London; North Atlantic, E. & G. W. Blunt, 1844, additions to 1847, New York; Bahama Banks and Gulf of Florida, E. Blunt, 1848, additions to 1853, New York; Gulf of Mexico, West Indies and the Spanish Main, E. & G. W. Blunt, 1845, additions to 1852, New York; Carte Générale de la Mer Mediterranée, etc., Maistre, Marseilles, 1849 (2 sheets); China Sea, East Indian Archipelago, by J. W. Norie, 1821, London; Chart to Book of Navigation in the East Indies, J. Horsburgh, Jan. 1, 1819, additions to 1849, London; Pilot Chart, North Atlantic, M. F. Maury, Sheet N° 1, 1849, Washington (in all, 10 charts).

From Guillaume Grandidier, Author :

Voyage dans le Sud-ouest de Madagascar, Conférence faite à la Société de Géographie (de Paris), le 5 Janvier, 1900.

From Jules Leclercq, Author :

À Travers l'Afrique Australe, 2e édition, Paris, 1900, 18° ; Anurádhapura sous les Rois Cinghalais, Bruxelles, 1900, 8°; Extrait des *Bulletins de l'Académie royale de Belgique* (Classe des lettres, etc.), N° 1 (janvier), 1900;—La Réforme Sociale: Bulletin de la Société d'Économie Sociale, etc., N° 93, 1er Janvier, 1900, *contenant* "Les Boers et leur État Social," par Jules Leclercq. Paris, 1900.

From the Macmillan Co., Publishers, New York :

First Book Home Geography and the Earth as a Whole, by Ralph S. Tarr and Frank M. McMurry, New York, 1900, sq. 8°.

From Dr. Fridtjof Nansen :

Norwegian North Polar Expedition, 1893–1896: Scientific Results, Vol. I, edited by Fridtjof Nansen, Christiania, et al., 1900, 4°.

From E. L. Plumb :

Remarks of Hon. John D. Bellamy, of North Carolina, in the House of Representatives, Thursday, February 1, 1900. Washington, 1900, p. 8°.

From Charles Schuchert, Author :

On the Lower Silurian (Trenton) Fauna of Baffin Land. From the Proceedings of the U. S. National Museum, Vol. XXII. Washington, 1900, p. 8°.

NOTES AND NEWS.

The American Museum Journal, Vol. 1, No. 1, April, 1900, is the first number of a new publication, intended to be a record of the progress of the American Museum of Natural History.

It is a handsome illustrated octavo, of sixteen pages, edited by W. K. Gregory, with Frank M. Chapman and L. P. Gratacap as Associate Editors, and will be furnished to subscribers monthly, except in June, July, August and September, for seventy-five cents a year. Address A. Woodward, American Museum of Natural History, 77th Street and Central Park, West.

Minerva, for 1899–1900, has for its frontispiece an admirable portrait of President Eliot of Harvard University, described in the *Vorwort* as the foremost of the prominent men who represent the higher education in the United States.

There is a steady growth in the number of references in *Minerva*, which now contains 1,166 pages, beautifully printed and with the minimum of error in so many thousand strange names. It is only in the two pages of the *Vorwort* that the printer has nodded, setting up in one place *Un dunter* for *Und unter*, and in another *Jür* for *Für*.

Volume LXII of the Dictionary of National Biography begins with the notice of Sir Adam Williamson (1736–1798), and closes with that of Wynkyn de Worde, the famous printer.

It is announced that the concluding volume of the Dictionary will be published in June, and with it subscribers will receive an index to each of the volumes 1–14, issued without indexes.

M. Auguste Descamps, in an article in the *Bulletin* of the Lille Geographical Society, No. 9, for 1899, notes the persistence of the Arab type in the population of certain villages in the east and south of France.

Fugitives from the battlefield of Poitiers in 732 took refuge, it is affirmed, in the region between the Saône and the Rhone, and their descendants, many of whom bear Saracen names, such as Cafoud, Buiroz, Salladin, Roum, look like Orientals, with their thin, dark faces, aquiline noses and penetrating black eyes.

The best-known Arab colonies are at Boz and Uchizy. At

Uchizy M. Descamps found an innkeeper and his family with the thick black hair and vivid eyes, the bronze faces and high, keen features of Algeria. A Parisian artist was sketching them as types for a Biblical composition, and they had the Arab gravity and dignity of bearing. Living on the frontier of Burgundy, the people of Uchizy inherit the Mohammedan aversion to wine.

THE JUSTIN WINSOR PRIZE of $100, offered by the American Historical Association, will be awarded this year for the best monograph based upon original investigation in American history. The work must be typewritten, or written upon only one side of the sheet, and ready for publication. Clearness, arrangement and literary form will be considered in making the award, and the successful essay will be published by the Association.

Prof. Charles M. Andrews, of Bryn Mawr, is the Chairman of the Committee.

LA REVUE DE GÉOGRAPHIE prints in its number for April, under the title of *Le livre d'or de la géographie*, the first part of an attempt at a geographical biography by M. P. Lemosof, covering the names from Abbadie to Azurara. In a brief introduction the author asks for the indulgence of his readers and invites them to suggest names worthy to figure in his list, which ranges through the world from antiquity to the present day.

It is not easy to understand the principle which has guided M. Lemosof. He finds a place for Agatharchides, but he omits Acuña, Adam of Bremen, Æneas Sylvius, Agrippa, Alfred the Great, and Aristotle. Abulfeda is duly registered, but Abdallatif is forgotten, and there is no mention of Azara.

If, as stated in the Introduction, the list is no more than a simple enumeration of names and dates, these should be correctly given.

Adam Afzelius is described in two lines as a Swedish savant, who was born in 1796 and lived for long years in Senegal. According to the biographical dictionaries Afzelius was born in 1750. He visited Sierra Leone in 1792, and in 1796 he was the Secretary of the Swedish Embassy in London.

In the notice of Louis Agassiz, it is said that he filled the chair of natural history at *New-Cambridge* (United States); that his journey in Brazil gave him his celebrity, and that his principal publication was *A Journey in Brazil.*

This appreciation of Agassiz is hardly relieved by the brilliant discovery of New-Cambridge.

Of Eivind Astrup M. Lemosof writes that he was a Swedish explorer, a member of the Peary expedition to the North Pole, and that he met his death in that enterprise in 1896.

Astrup was a Norwegian, not a Swede. He went with Peary in 1891, not to the North Pole, but to Greenland, and returned in 1892. He met his death in 1896, no one knows how, in the woods in Southern Norway.

There is room for improvement in the *Golden Book of Geography.*

THE OSTSCHWEIZERISCHE GEOGRAPHISCH-KOMMERZ. GESELLSCHAFT of St. Gallen makes known the death, on the 26th of March, of its Vice-President, Herr Konsul Otto Dürler, at the age of fifty-five years. Herr Dürler had lived for a long time at Batavia, where he was Swiss Consul, and returned to his home in 1892, apparently well, but with vitality impaired by the climate of Java.

TRANSACTIONS OF THE SOCIETY.

MARCH–APRIL, 1900.

A Regular Meeting of the Society was held at Chickering Hall, Fifth Avenue and Eighteenth Street, on Monday, March 19, at 8.30 o'clock P.M.

Vice-President Tiffany in the chair.

Mr. Thomas McCaleb, recommended by the Council, was elected a Fellow.

The Chairman announced that the present meeting would close the relations maintained for so many years with Chickering Hall, now to be turned to other uses.

He then introduced the speaker of the evening, President Schurman, of Cornell University, who addressed the Society on the Philippine Islands and their People.

On motion, the Society adjourned.

A Regular Meeting of the Society was held at Mendelssohn Hall, No. 110 West Fortieth Street, on Tuesday, April 17, at 8.30 o'clock P.M.

Vice-President Moore in the chair.

The Chairman called for the report of the Nominating Committee, which was read by Mr. Henry Parish, as follows:

AMERICAN GEOGRAPHICAL SOCIETY.

APRIL 7, 1900.

The Committee appointed by the Council on the 9th of December, 1899, to recommend suitable persons to fill vacancies in the offices of the Society, and which reported in part in January, 1900, now makes final report and recommends the election of the Hon. Seth Low to the office of President.

HENRY PARISH,
CHANDLER ROBBINS,
LEVI HOLBROOK,
Committee.

The Chairman asked for a *viva voce* vote on the nomination, and Mr. Low was unanimously elected.

The speaker of the evening, Mr. H. L. Bridgman, was then introduced. He described the cruise of the *Diana* to Greenland in 1899, and Mr. Peary's work in the Arctic in 1898–99.

On motion, the Society adjourned.

BULLETIN

OF THE

AMERICAN GEOGRAPHICAL SOCIETY.

Vol. XXXII **1900.** **No. 3**

THE SUNDAL DRAINAGE SYSTEM IN CENTRAL NORWAY.

BY

R. L. BARRETT.

Introductory.—This paper originated in a study of Norway made in the geographical laboratory at Harvard College. From the laboratory I went into the field in the summer of 1897, and made a hasty examination of various points on the coast and on the highland of Norway, travelling by sea and land from Hardanger fjord in the south to Vardö in the north. The results obtained led me to concentrate my attention in the summer of 1898 on the region between the Romsdal and Trondhjem. Several rainy months flew by in the study of the valleys in this region, those of the Sundal system in particular. When the snow drove me from the field Dr. Hans Reusch, chief of the Norwegian Geological Survey, very kindly offered every facility for working up the results in Kristiania. Later on, before completing this paper, I had the advantage of talking the work over with Prof. W. M. Davis. Both Prof. Davis and Dr. Reusch have very kindly read and criticised the manuscript.

Valleys and Watersheds in Norway.—The two distinct sets of valleys which Prof. E. Richter* describes for southern Norway are well represented in the north. Everywhere comparatively shallow valleys may be seen mouthing high and abruptly on the walls of deep cañons. The southern high valleys, Richter says, are remnants of old and comparatively shallow valley systems which once headed near the present watershed of the country and drained west along the lines of the present deep fjords and fjord valleys. Today's disjointed relation between the old high valleys and the young fjord valleys or cañons he explains by supposing that at various times during the glacial period the swifter and stronger ice-streams moved down the trunk valleys, while the slower and weaker streams followed the tributary valleys. As a result the trunk valleys wore down rapidly and began to break joint with the tributaries. At other times during this period, when the great glaciers retreated from the trunk valleys, névé continued to lie on the surface of the uplands and little glaciers gathered in the higher tributaries. Thus the trunk valley floor, exposed to the action of running water while all other parts of the system were protected by the ice cover, tended still further to break joint with the floors of the tributaries.

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* Geomorphologische Beobachtungen aus Norwegen, Sitzungsberichte der k. k. Akad., Wien. Math-naturw. Classe. Bd. 105, Abth. I, 1896, p. 147–189.

There are plenty of remnants of these old upland valley systems in the south between the Skager Rak and the Atlantic, heading on the main watershed of the country, and trending west. Similar remnants occur on the opposite side of the divide, trending southeast. These normal conditions—mature valleys heading on either side of the divide and draining away from it—appear to prevail as far north as the Ottadal (plate 1). Beyond this there is a striking change, which begins about 30 kilometres south of the mouth of the Romsdal, where the main watershed turns from a north and south line to one almost east and west. The watershed in the region of the Romsdal no longer lies between the heads of mature systems, one draining southeast and the other west; it lies instead on the floor of one of the southeast trunk valleys. The original heads of the southeast system lay many miles west of the present divide. These heads are now cut off from the southeast system, and drain as high valleys in a barbed or backhanded fashion into the deep young Romsdal cañon, whose stream flows northwest.

The New Boundary of the Sundal System.—North of the Romsdal system, and strongly resembling it, lies the Eikedal. Northeast of the Eikedal lies a variant from the Romsdal type, namely, the Sundal system, with which this paper is directly concerned. The gorges and cañons of the young Sundal system which drains northwest are divided from a certain mature valley system (hereafter called the Opdal system) which drains northeast and north, the streams from both systems reaching the Atlantic. The divide between them has suffered even a greater shift from west to east than was the case with the main divide in the Romsdal.

The object of the present paper is to present the arguments

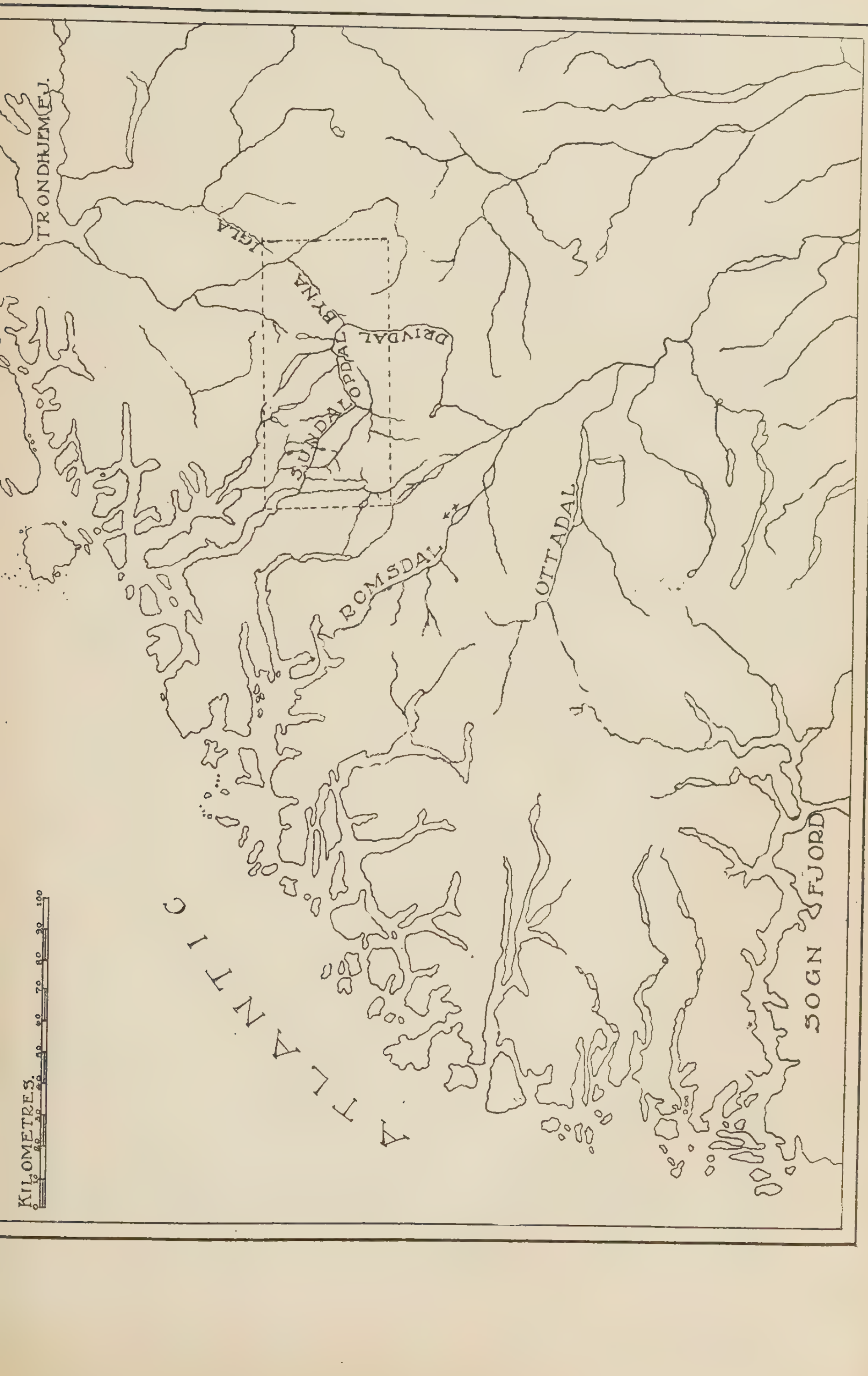

PLATE I.—OUTLINE DRAINAGE MAP OF CENTRAL NORWAY. THE RECTANGLE SHOWS THE AREA OF FIVE OUTLINE MAPS IN THE TEXT.

which have convinced me that the divide in question once stood near the head of the Sundal fjord, more than sixty-five kilometres west of its present position, which is just south of Aune in the mature trunk valley, and that the processes which shifted the divide are largely responsible for the peculiar features of the present Sundal system, with its cañons and high valleys.

My plan is: to reconstruct the mature valley system (Opdal) from its many disconnected ends; to describe the young cañon system (Sundal); to show the relations between the two; and to suggest explanations for these relations. Two sections headed "Details . . . ." contain accounts of certain items that are necessary to a full statement of the problem, but they may be passed over in a first reading.

Among the illustrations are five diagrams. On the first (Figure 1, plate 2), which is the name-key to the other four, there are several departures from the names given on the official map. For the sake of simplicity the names, North fork and South fork, have been applied to the branch cañons of the Sundal, and the name Gjeitdal has been extended to cover the lower as well as the upper part of a certain valley. The words, west and east, have been introduced at opposite ends of the Grödal for convenience in describing that valley. The suffix "dal" (valley), which appears in all the valley names on the key, has frequently been omitted in the text; the valley name being used alone.

The chief rocks, in the greater part of the region, which is shown in figures 1–5, are resistant archaean gneisses. Their folia have a fairly uniform strike across the region, about east and west, and a dip varying from perpendicular to nearly horizontal. The strike is crossed by the Sun and by some of the mature valleys diagonally. Others of the mature valleys are almost parallel to the strike, and still others cross it at right angles.

The Mature Opdal System.—The region is a highland, deeply dissected, but presenting comparatively even skylines. These become more and more even northeastward, as the surface falls off in height in that direction, until they form practically straight lines. Much of the highland surface is flat and quite as easy of access from the valleys as one valley is from another, but the highland does not attract farmers, for it is far too high to live on. In these latitudes there are few farms above 700 metres, and, as far as I know, none above 800; whereas the highland at its lowest is 1,300 metres and at its highest 1,800. It is almost absolutely barren; a high, cold

FIG 1.

FIG 2.

FIG 3.

FIG 4.

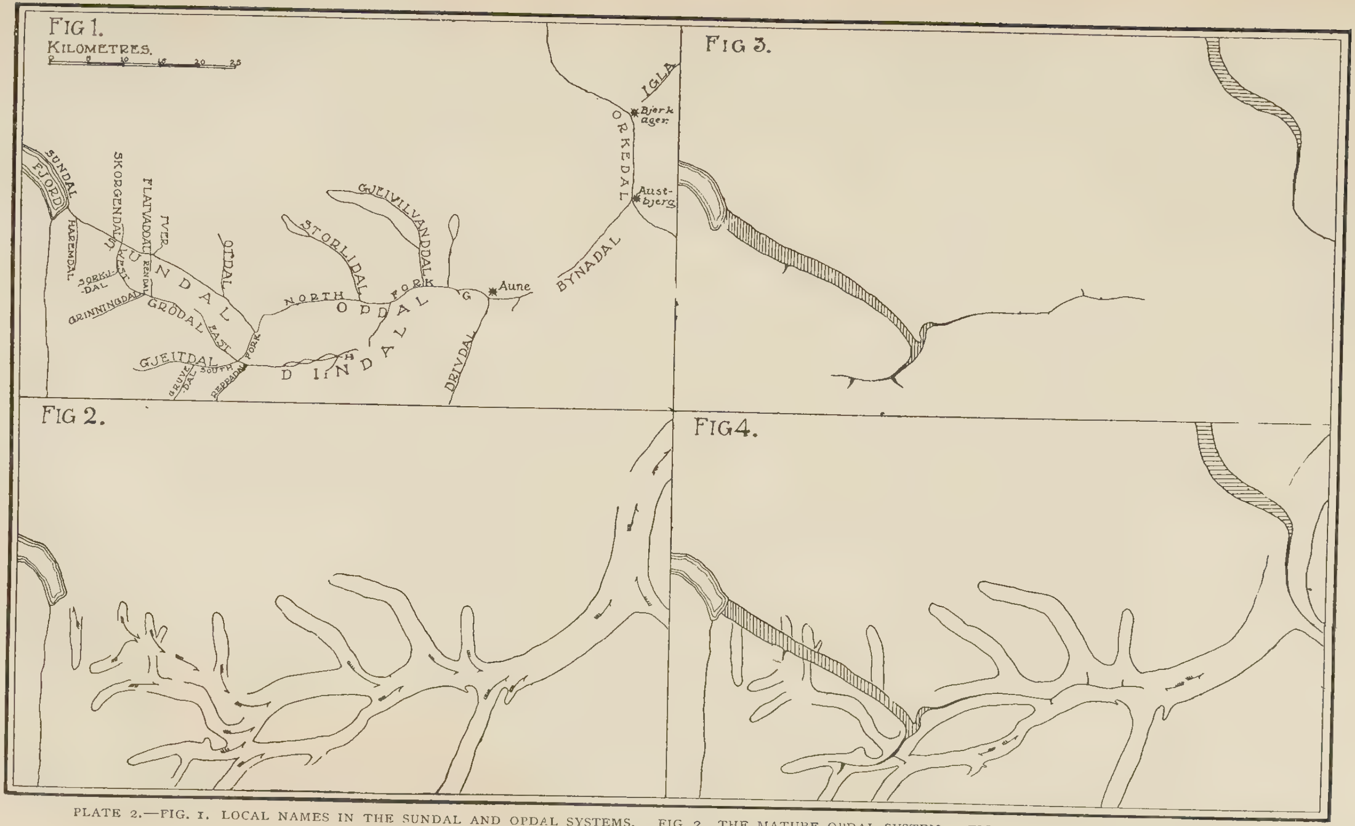

PLATE 2.—FIG. 1. LOCAL NAMES IN THE SUNDAL AND OPDAL SYSTEMS. FIG. 2. THE MATURE OPDAL SYSTEM. FIG. 3. THE YOUNG SUNDAL SYSTEM. FIG. 4. COMBINATION OF THE OPDAL AND THE SUNDAL SYSTEMS.

desert of rock and snow, relieved here and there by swampy or laked hollows. Although there is a vast quantity of fresh-looking rock waste over much of the surface, there is practically no fine soil. The cover of rock waste, attributed by Prof. A. Helland, of Kristiania, to frost work since glaciation, contrasts oddly enough with the bare rock in the floors of many of the high-level, mature valleys. In these, frost action seems to be much less active in splitting up the rock surface into coarse waste. The little fine soil which has formed has collected as black mud in the hollows, leaving much of the rock bare. The little mare which carried my pack, and was my only companion during a large part of the summer's work, could testify to all this; to the bleak highland, on the lower parts of which she spent more than one cold and hungry night, and to the equally bleak valleys where she found the edible grass blades—when there were any—growing a yard apart, and where she sometimes slipped and fell on the smooth, bare rock trails, and often had to struggle through the deep, sticky mud in the hollows.

The high-level valleys which are sunk beneath the highland in this region are of mature expression. In no sense are they valleys belonging to a peneplain, such as the highland may have been. If the highland country in which they lie has ever been a peneplain, it must have been greatly uplifted to enable the valleys to attain their present depths, and must have stood at the level then reached for a considerable time, to enable the valleys to attain their present low grades.

The high-level valleys of the region under consideration are not immediately connected to-day, but a study of their relations to one another shows that they once belonged to a large mature valley system which drained east and northeast from sources in the highland over the head of the present Sundal fjord to a station, Stören, some distance down the trunk valley of the mature system. Figure 2 (plate 2) shows this system from its western valley heads to within a few miles of Stören. The original plan of drainage and the relations of the various fragments to the system as a whole are shown by arrows. The accordance of the various valley floors throughout the system, despite the disconnected condition of the parts, is very striking. Practically all the heights along the floor of the trunk valley and along the floors of the connected and disconnected branches, except in one or two places where glacial obstructions occur, accord with the descending slope of a single valley system made up of all these pieces, as is shown by the altitudes on figure 5. Moreover, all the branches, except two short gulleys (H in the Din and G opposite the Gjeivilvand, figure 1), which appear to have been worn in fractures, trend in sympathy with, or at right angles to, the trunk of the system.

The lower part of the trunk valley is a broad, shallow, well-matured valley, incised in a particularly smooth part of the highland, which slopes gently down to the northeast. The upper part of the trunk valley and its branches are by no means as well matured as the lower. As a rule they are deeper and more steep-sided than the latter. Their steep-sidedness is appropriate in any case, as the lower course of a valley system always matures before the upper course. Their greater depths are due to the fact that while the grades throughout the system are fairly uniform, the highland in which the upper part is incised is very much more elevated than that in which the lower part is incised.

FIG 5.

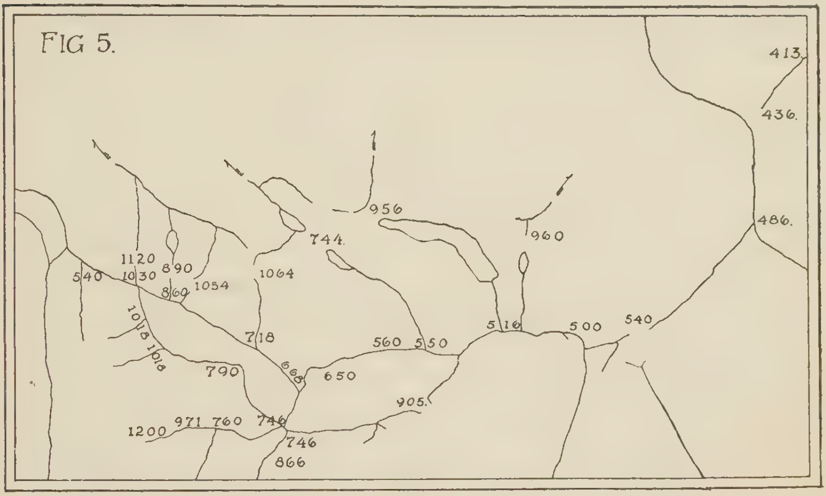

FIG. 5.—ALTITUDES, CHIEFLY IN THE OPDAL SYSTEM.

The rather gentle side-slopes of the shallow lower trunk valley were once heavily timbered, but are now more or less cleared of timber and used for hayfields. As the valley system ascends, its floor gradually rises above timber-line. Its uppermost parts, if bearing any trace of man at all, have nothing more than small rough stone huts, which afford a night's shelter to the passing hunter. A little lower down appear the saeter huts, where the women live in summer to milk the cows pasturing there and to make cheese and butter from the milk. Still lower down, the farms begin to appear; at first few and far between, then closer and closer together, until in the better-preserved middle part of the system a large portion of the broad valley floor is covered with farms and traversed by roads connecting them. All this stands in striking contrast to the entirely uninhabited highland surface in which this valley system is incised.

Being to-day composed of disconnected parts, this valley system, of course, has no one name, but instead a different name for every separate part, as may be seen by comparing figures 1 and 2. I shall call it for short the Opdal system, after the name of the most populous part of the trunk valley.

The Young Sundal System.—Turning now to the young cañons and gorges, represented alone in figure 3, plate 2, attention is first attracted by the great Sun cañon. The Sun extends, in southeastward continuation of the somewhat sinuous Sundal fjord, as a remarkably straight, broad and deep cañon for more than thirty kilometres through the highland. The cañon's floor near the fjord is eighteen hundred metres below the highland surface and more than one thousand metres below the floor of a certain high valley, a detached fragment of the mature Opdal system, which here mouths abruptly on the wall. The relief decreases somewhat up-stream as the highland surface falls off in that direction. Moreover, the highland south of the cañon, in this upper part, is lower than the highland north of it, because of a *graben*-like depression of the highland surface which lies between the Sun and the Grö.

The walls of the cañon are very steep, often inaccessible to within a hundred metres of the actual surface of the highland, where they flare out. The talus is scanty as a rule, and varies greatly in quantity from place to place. When present it is clothed with small trees and bushes on its lower slopes, but its upper slopes and the cliffs above it are bare. Here and there talus is altogether lacking, and the bare rock appears, smooth as if ice-rubbed. The cañon is floored with a flat drift plain, terraced by a stream which still runs on the gravels in a steep-sided trench. There is a quiet little village on the gravels at the cañon's mouth, and the broad plain back of the village is covered with farms and traversed by several roads. As the plain narrows up-stream, the farms become fewer and the several roads merge into the main highway.

Details of the Sundal System.—The average cross-section of the cañon is approximately that shown in figure 6. There is, however, a marked departure from this cross-section in the portion between the western Grö and the Harem. Here the southern side retreats, as shown by the dotted lines, and a strong cliff (A) extends parallel to the Sun from the Harem to the Grö. A weaker cliff but one on the same line as the other appears across the western Grö (B, figure 7). A short distance up the western Grö from the cliff, a fresh-looking crack, along which there appears to have been a slight vertical movement, crosses the valley on a line parallel with the cliff. The crack and the cliff, both thus approximately parallel to the Sun, taken in connection with the curious one-sided broadening of the Sun itself, between the Harem and the Grö, are suggestive of a small *graben* here.

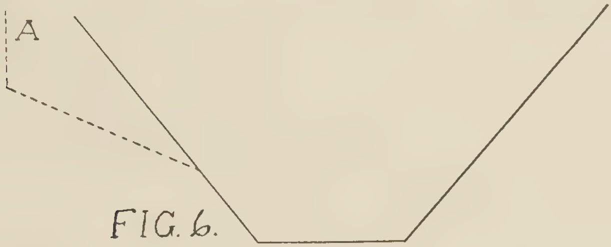

FIG. 6.—SECTION OF THE SUNDAL.

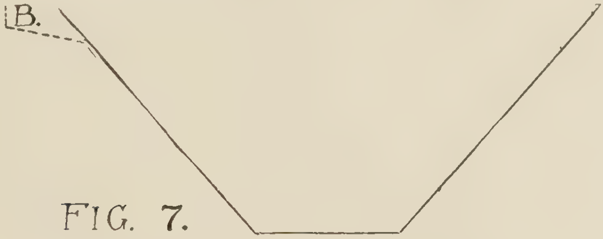

FIG. 7.—SECTION OF THE SUNDAL.

The deep and wide part of the cañon which I have been describing thus far heads abruptly against a low part of the highland; another *graben*-like depression. Branch cañons lead off at right angles to the north and south. These are much shallower than the main, because they are cut in the floor of the mature trunk valley of the Opdal system instead of directly in the highland. They are also much narrower. The one trending north, the North fork cañon, continues, drift-floored and habitable, for a few kilometres up-stream from the branching point. Then it swings round to the east and changes rather abruptly into a much smaller and generally narrow, uninhabitable stream-cut gorge, which extends on up to Aune in the mature trunk. As this narrow gorge is incised in a valley floor, which becomes lower and lower as it descends in the opposite direction to that in which the stream flows, the gorge shallows rather more rapidly than it otherwise would. Three very short branches lead off—one toward the Storli, one toward the Gjeivilvand, and one toward the Din. The South fork cañon, like the North, continues drift-floored and habitable for a kilometre or two up-stream, and then passes into another narrow, uninhabitable stream-cut gorge. The gorge swings round to the west and extends far up into the Gjeit, with a small branch in the Din and another in the Gruve.

A very striking feature of the Sun and the North fork, which together constitute the trunk cañon of the young Sundal system, is the habit of their tributary streams from the high mature valleys to trend, like barbs, out of sympathy with the trunk. This young trunk cañon, with its various branch cañons and the numerous high fragments of the ravaged old Opdal system, which now discordantly drain into it, constitute what I have called the Sundal system.

The Young Orke System.—There is another cañon, called the Orke, similar to the Sun, but shallower, which lies in the eastern part of the region. Like the Sun's forks, the Orke passes rather abruptly into a narrow, uninhabitable gorge, which extends from Austbjerg to Bjerkager and beyond (see figs. 1 and 3).

Relation of the Orkedal and Opdal Systems.—Thus far I have described the young Sundal and Orke systems and the mature Opdal system separately. Now, I propose to show their relations, as summarized in figure 4, plate 2. The lower trunk of the Opdal system appears, from most points of view, to be one continuous old valley. As a matter of fact, however, a stream from part of it escapes northward through the Orke cañon, which pierces the trunk valley side at Bjerkager; while a beheaded lower stream continues in the mature trunk valley, here called the Igla, toward Stören. The floor above Bjerkager, as before stated, is trenched by a narrow gorge, the continuation of the Orke cañon, as far as Austbjerg. The remnant lateral benches of the mature floor, each traversed by a road and occupied by farms, and the medial gorge, uninhabitable and impassable, between them, stand in striking contrast to each other. At Austbjerg the gorge switches off up a branch valley to the southeast, leaving the up-stream floor of the mature trunk valley intact, not trenched at all.

The stream in the trunk valley above Austbjerg is called the Byna; it is very small, and totally out of proportion to the valley. The size of the valley would lead one to expect, instead of a small, weak stream, a large river, well able to trench its valley floor. In fact, it can hardly be doubted that the Opdal trunk was once occupied by a large river flowing northeastward, whose upper waters have since been directed to some other discharge.

The Sundal and the Opdal Systems.—The diverted part of the Opdal drainage comprises, as may be seen by comparing figure 2 with figure 4, all the water south and west of Aune which to-day escapes westward in the gorges and cañons of the Sundal system. The diversion, as before stated, appears to have resulted from a shift of the Sundal-Opdal divide from its original position in the highland above the head of the Sundal fjord to its present position in the floor of the Opdal trunk near Aune. The divide lies to-day about six kilometres northeast of Aune on glacial material, which buries the rock floor at this point to a depth of thirty metres, or more.

A small branch valley just east of Aune trends in sympathy with the old system. Its stream, however, on entering the trunk, instead of finding a master flowing northeast, as it probably did before the above-mentioned changes, finds a very different state of things. It now joins, as a barb, a small stream heading on the modern divide of glacial material, and flowing backward into the head of the North fork gorge. The gorge leads the water west through the floor of the Op to the Sun. The large Driv also trends in sympathy with the Opdal system, and when seen from near Aune looks as if it must have been a branch of the trunk valley. Its stream, however, instead of flowing on down the trunk valley, as it doubtless once did, now bends sharply round, barb-fashion like the other, and flows with it into the North fork gorge.

The Op, in whose floor the upper part of the North fork gorge is cut, seems unquestionably to be a part of the trunk of the mature Opdal system. As has already been said, the floor of the mature trunk, formed by the Op and the various other valley sections, rises almost continuously from its lower part by Stören, to the southwest and west. There is but one exception to the general rise, namely, the divide formed just below Aune by glacial gravels, but these very probably overlie an uninterrupted rock slope. Four large tributary valleys enter the Op section at its floor-level. Three of these trend in sympathy with the trunk valley and one at right angles to it. Their streams fall, three of them barb-like, into the North fork, which leads their water west against the slope of the floor of the mature trunk valley.

The North fork gorge is very shallow near its head, hardly to be suspected in the broad Op floor. As it grows deeper and more cañon-like westward, it becomes broader and more conspicuous; while the mature floor which once stretched all across the valley dwindles away to comparatively narrow and somewhat dissected benches on either side.

The broad, mature floor of the trunk valley and its branches in the Op section are occupied by farms and by roads connecting them. Several farms stand abreast in the lower part of the Op. As, however, the uninhabitable gorge gains in size westward, the farms are forced into single file on the narrow remnant benches of the mature trunk valley. One good road on the north and a bad one on the south suffice to connect them. As the lower part of the North fork is approached the highway on the northern bench descends, cutting its way in the cliff on the side of the gorge. It reaches the bottom just where the drift-plain begins. Soon after the road descends from the northern bench, the farms disappear from both benches and saeters only remain.

The mature trunk now swings round to the south along the line of the lower North fork. The continuation of the northern bench in this quarter becomes indistinct for a time, but presently reappears clearly in the shape of a long, flat-topped spur in the angle between the North fork and the main Sun. The spur corresponds to a broad, continuous bench which lies along the eastern side of the North fork, across the head of the Sun and along the eastern side of the South fork; also to a bench on the western side of the South fork.

The spur apparently lies where the mature trunk was joined by a branch coming from the west, along the line of the Sun. There are suggestions of remnant benches of such a branch valley even along the Sun's sides, but these are very faint and not to be depended upon. Remnants still more striking than benches, however, remain to mark a mature branch that has been destroyed by the erosion of the Sun cañon. These are an ascending series of high valleys which mouth abruptly on the Sun's northern wall (figures 2, 4, 5). The first one mouths at seven hundred and eighteen metres, fifty metres higher than the top of the spur, the next at eight hundred and sixty metres, and the next at ten hundred and thirty metres. All three have low grades, head on low divides, and trend in sympathy with the supposed branch. The Ot and Flatvad have cross sections like that of a deep bowl. The Skorgen's cross section is like that of a shallow bowl. Both the Skorgen and the Flatvad are very much shorter than the Ot. A fourth valley, the Sorkj (not Skorgen), also appears to be a fragment of the mature branch. It is one of the short, broad, shallow-bowl type. It trends in sympathy with the supposed mature branch and mouths high (ten hundred and thirty metres) and abruptly on the western wall of the western Grö. The western Grö, as stated above, enters the Sun at the floor-level of the latter as a deep young V, the only low normal tributary to the cañon on its whole course of thirty kilometres. In brief, the suggestions are that when the Opdal system was intact it had a long branch on the line of the Sun (but at a higher level) with all these short tributaries. To-day the floor of the branch is gone, and instead one sees the deep, young Sun cañon and its off-shoot, the western Grö, with the short tributaries mouthing high and abruptly upon their sides.

The Sun cañon not only runs the whole length of the lost branch of the Opdal, but also penetrates the floor of the mature Opdal trunk at the point where the lost branch once joined it. To the north and northeast extends the North fork cañon, which has already been described. To the south and southwest one can see the remnant benches of the partly matured trunk valley, with the South fork cañon between them. This cañon narrows and shallows up stream until it finally dies out far up the Gjeit, where the partly matured valley remains intact.

Details of the Grö, Din and Gjeit Valleys.—The eastern Grö, a low-grade valley, with a shallow-bowl cross-section, mouths abruptly on the southern wall of the South fork just before this cañon turns up the Gjeit. The eastern Grö's stream heads on an almost imperceptible divide, flows for a few kilometres on the gently sloping floor, and tumbles in a waterfall into the gorge. The very similar Din mouths opposite at the head of a short branch gorge; and between the Din and the Gjeit mouths the somewhat deeper and narrower Reppa. All four valleys mouth thus like spokes in a hub—three on the gorge and one with the gorge in its floor, as close together as they can squeeze in. This disposition of valleys is abnormal. It is probably due to the inosculation of two parts of the mature Opdal system; an extended Gjeit, forming the upper trunk of the system, and a Reppa-Din branch (figure 2).

The Din, although it bears but one name, has a low divide on its floor, from which one stream flows east and another west. It is what Richter calls a "double valley." The divide lies on glacial gravels which fill the valley from end to end. They may have been poured in at a curious opening (I on the key) in the southern wall which affords connection with high collecting grounds for snow. The gravel deposits are eroded, but little if any in the central portion; but at the mouths of the streams they are trenched down to the rock floor, some sixty metres below their surface. Much of the deposit between the divide and the western mouth was apparently formerly pitted with deep hollows and the hollows were filled with lakes. Since then the lakes have lowered their outlets in their kame-like barriers, and nothing now remains but a set of very shallow, almost streaming, water bodies. There is every reason to suppose that no divide exists on the rock floor itself under all these gravels, but that there is instead a continuous slope from the present. visible rock floor in the western end down to that in the eastern end of the valley. If this is assumed to be so, it is necessary only to replace in imagination the lost part of the dividing wall between the Reppa-Din and the extended Gjeit to show what an appropriate head for the Din the Reppa is. The rock floor in the Reppa's mouth is practically at the same level as that in the Din's western mouth, a trifle higher if anything, and the trend of the valley is just as it should be to fit the Din. The Reppa-Din thus reconstructed would make a branch to the mature Opdal system, trending in perfect sympathy with it. On the other hand, if it is supposed that there were no Reppa-Din, but that the greater part of the Din drained west as now, the Din would have joined the extended Gjeit part of the mature trunk valley as a barb, trending quite out of sympathy with the Opdal system. It would have then formed one of the four valleys which to-day mouth abnormally, close together—three on the gorge and one with the gorge in its floor.

The Din for some reason is occupied by saeters only. Its former head, the Reppa, contains but one even of these, probably because of its depth and narrowness. The lower Gjeit is deserted because the gorge occupies most of its floor. A graben-like broadening in the central part of the last-named valley is, however, occupied by farms, and there are saeters where the intact floor of the upper part begins. In the mouth of the eastern Grö there are several farms, and up the valley are numerous saeters. The various benches between the mouths of the four valleys support two or three isolated farms.

The name Grö, like the name Din, applies to a double valley, with streams draining either way. On the flat divide in this valley, unlike that in the Din, bare gneiss appears through the glacial gravels. Just east of the divide the valley makes a sharp angular turn from east to south (figure 2). East of the turn a cross-section is like that of a shallow bowl. West of it the valley is broader still, with a cliff on the south and a rather gentle slope most of the way on the north. The floor has little slope either way for several miles. Some distance west of the divide the valley begins abruptly to deepen. It passes into a very deep, narrow U and curves round north as if about to mouth abruptly on the Sun's southern wall, like the Ot on the northern wall, but much lower than that valley and at about the same level as the Harem. It does not reach the Sun's wall in this form, however, for a narrow cañon starts in its floor two or three kilometres back from its mouth. This cañon widens and deepens towards the Sun, and as it does so the benches of the U floor on either side dwindle and finally disappear. The valley, instead of mouthing on the Sun as a high U, enters, as already stated, as a low V about at the Sun's present level.

A valley called the Grinning, whose cross section is like that of a shallow bowl, mouths abruptly high up the side of the deep narrow U of this western Grö, just where the U begins to swing round from west to north. The deep U thus intervenes between the shallow Grinning and the shallow central part of the Grö. The Grinning trends so nearly in the same direction as the central part of the Grö that one standing on the Grö's divide and looking west gains the impression that the Grinning is a detached fragment of a former Grinning-Grö branch of the Opdal system.

High-level Tributaries of the Sun Cañon.—The tale of the double valleys does not end with the Grö and the Din. The Ot, the Tver, the Flatvad, the Ren, and the Skorgen are all double valleys. Perhaps the most notable of the five is the Flatvad. It is a remarkably straight, deep, north and south trench, with an almost imperceptible divide, not two kilometres from the Sun. It mouths abruptly at both ends on cañon walls. Exactly opposite this valley across the Sun mouths the Ren. The Ren is a small double valley between the Grö and the Sun, trending in about the same direction as the Flatvad. An example of a different type is the Skorgen. The ascent to this valley from the Sun is very steep, like that to the Flatvad. The valley floor is fairly flat for several kilometres. Beyond this the floor rises abruptly in a vast wall, perhaps 100 metres high, which, save for a breach near its eastern end, completely blocks the valley. The traveller passing through the breach or climbing to the top of the wall and looking north finds himself on the edge of a great amphitheatre, whose floor lies three hundred metres below him. The valley looks as if made by two cirques at different levels, which wasted backward towards each other until the dividing wall between was breached, or until some other process than the wasting breached it. As in the case of the Flatvad, so here, there is a corresponding valley across the Sun directly opposite, namely, the Grö. But the Grö, unlike the small, shallow Ren, is a large, deep valley.

Thus far I have traced the mature system up the Gjeit, up the Grö to the Grinning, and up the Sun to the Skorgen and Sorkj. In so doing I have considered all the important valleys in the western part of the region under discussion except one—the Harem.

The Harem is a tributary to the Sun close to the fjord. The valley mouths at right angles to the Sun five hundred and forty metres above the floor of the latter, that is, at about the level the deep U of the western Grö would have if it reached the Sun's wall. The Harem is the deepest of all the high valleys. Its floor is one hundred and seventy metres lower than that of the Ot, the lowest of the high fragments of the Opdal system, and five hundred metres lower than that of the highest, the Skorgen. It is about as long as the Ot, and has a similar cross section, a deep U, but its fall from head to mouth is twice as great. The descent is chiefly in two steps, one of them very strong. Between the steps the valley is of rather low grade. The top of the upper step is the very high flat floor of a valley draining in the other direction. The extraordinary depth of the Harem and the Grö, as compared with the various valleys of the Opdal system described above, is rather remarkable. Possibly they once belonged to this system, but have since been acted on by ice, or some other agency, much more violently than their sister tributaries. Possibly the Harem belonged to a contemporaneous system draining northwest along the line of the present Sundal fjord. Such a system as this latter must, of course, have been very much shallower than the present fjord. On the other hand, it must have been much more deeply incised at its head than the mature Opdal system, which drained in the opposite direction.

Summary concerning Reversal of Drainage.—What I have tried to establish thus far is as follows: There was a large mature (Opdal) valley system rising in the highland over what is now the head of the Sundal fjord and draining east and northeast towards Stören. There was another system contemporaneous with this but deeper in its upper tributaries, which rose close to the head of the first and drained northwest to the sea. The divide between the two has shifted to such an extent that the greater part of the large mature system which formerly drained east and northeast now drains west against its old slopes in deep, young gorges and cañons. As the gorges and cañons deepen downstream through the rising head valleys of the Opdal system, the main Sundal cañon comes to be one thousand metres deeper than the highest head valleys that it dissects. In the cañoning, large portions of the mature valley floors have completely disappeared; and narrow benches alone remain to mark them elsewhere. In some of the larger branches of the mature system, that over the Sun in particular, the entire floor has disappeared, and the tributaries are left as isolated fragments of the lost branch, hanging up high on cañon walls.

Explanation of Reversal of Drainage.—Now that the main facts regarding the reversal of the drainage have been set forth, with such explanation of curious details as seemed necessary, I have some suggestions to offer as to the explanation of the reversal. It is manifest that the chief change occurred in the highland on the line of the former Sundal-Opdal divide, and especially where the great Sun cañon has been eroded across the divide. Several factors occur to me as probably instrumental in this change, namely, guided headward erosion by the Sundal system and capturing of the Opdal branches; unguided headward erosion and capturing; erosion by the outlets of ice-dammed lakes which overflowed from the Opdal system to the early Sundal system; and glacial erosion.

The general form of the land suggests headward erosion and capturing on the part of the early Sundal system, for the slopes on the west are steeper than those on the east, and the distance to the sea is shorter. These conditions prevail only in the reversed drainage area of central Norway north of the Ottadal (plate 1). South of the Ottadal, where there has been no reversal of drainage, the slopes and distances to the sea east and west are much more nearly equal.

The region is full of suggestions of fault lines. Most important among these are the boundaries of two large *graben*-like blocks mentioned above as lying low in the highland. Along these boundaries four of the more important of the valleys discussed have been excavated. Two of the valleys are notable for their angularity, and the third, the Sun, for its straightness. Headward erosion, guided by some of these lines of weakness, or even unguided erosion through the massive rock, might seem a reasonable process of capture and reversal of drainage were it not for the following important feature, which argues against the occurrence of either of these processes on a large scale: None of the diverted high-level tributary streams have trenched their floors to any considerable extent, and the smaller of them have not trenched at all. This quite excludes capturing from the upper part of the Sundal system, where the larger tributaries occur; for no one would believe that the slow process of headward erosion had power to cut a long cañon like that of the North fork, while a large diverted tributary valley like the Storli, whose mouth has been passed on the way, remains practically untrenched. On the other hand, the capture of the smaller high-level tributaries of the Sun cañon by headward erosion, although unlikely, is not altogether excluded. These tributaries are very weak and have little power to trench. The short trenches that they did cut, if they cut any, may well have been obliterated in a subsequent widening of the Sun cañon by ice. It seems, however, impossible, even in this district, to say how much capturing by headward erosion took place. Headward erosion and capturing thus appear uncertain in their application.

The ice of the glacial period has wrought many and great changes in all the valleys before and after the completion of the reversal of drainage, for every one of the valleys bears the mark of ice erosion more or less deeply. The shapes of most have been changed from the V section to the typical U section. The floors of some have been furrowed as if by a gigantic plough; and one long deep valley which lies at right angles to the ice movement has come to exhibit enormous examples of *roches moutonnées*.

But the first cause of the drainage reversal seems to me to be the overflow of ice-dammed lakes. If it is assumed that the mature Opdal system was practically intact in its western branches when the ice-sheet appeared, it is probable that a series of events somewhat like those set forth in the following paragraphs took place:

Reversal by Overflow of Ice-dammed Lakes.—As the glacial period came on, a vast quantity of water in east-sloping valleys was dammed back by the ice and forced to flow out to the west over cols in the highland; the Sundal cañon not yet being begun. As the ice-sheet advanced on the lower Opdal system, outlets from the heads of high-level valleys were found to the northwest. The first of these were closed as the ice continued its advance, and others further west at higher levels were chosen by the water. The Ot, for example, formed an outlet after the mouth of the Storli was closed. The Ot—then, doubtless, a normal tributary to the Opdal system—is now a double valley. It mouths on the north at the floor-level of a valley draining northwest, and on the south high up the Sun's wall. The next outlet, after this was closed, was through a gap in the highland where the Flatvad and the Tver are now. Previously streams in this gap had doubtless flowed south and joined a master in the normal way. Both masters must then have been at the level of the streams in question. To-day four of these streams run in two parallel double valleys. One of them so closely resembles a single valley that the one name—Flatvad—covers the whole. Both valleys mouth high and abruptly at either end on cañon walls, and their streams go tumbling down long distances in cascades and waterfalls to find their masters. Directly opposite the Flatvad, across the Sun, mouths the double Ren. Further west on the Sun, in a similar relation to each other, mouth the Skorgen and the western Grö. The Skorgen is a double valley, although of a different type than the Flatvad, and the double Grö mouths exactly opposite. The Grö to-day, to be sure, mouths many metres below the Skorgen, but this deepening may well have taken place since a time when the two were near a common level. As an outlet from an ice-dammed lake formed in the Grinning-Grö to a similar lake in the mature branch over the Sun, the then eastern Grö must have been shallow.

The form of the Flatvad and the Ren and the relations among all four valleys recall in a general way the cross valleys in central New York, described by Gilbert, Quereau, and Fairchild. In the neighborhood of Syracuse there are a number of streams flowing north in deep valleys between the spurs of an upland that slopes to the north. Through the spurs run several channels, opening at either end above the floors of the north-draining valleys, and sloping gently from the valley on the west to that on the east. The floor of each channel is higher than the upland surface about the channel next north. The channels between any one pair of north-draining valleys are roughly in line with those between the next pair. It is supposed that these channels were formed during the retreat of the North American ice-sheet by the overflow of the water along its southern margin.

The Norwegian cross valleys, in so far as they are due to the overflow of lakes dammed back by ice, were probably cut during the advance rather than the retreat of the ice. For when the water rose high enough to flow out directly west, the cutting of the present Sun cañon started and the level of the water began to be permanently lowered; hence on the retreat of the ice the Sun cañon would retain the overflow.

Erosion by Overflowing Glaciers.—Ordinary stream erosion ceased when the glacial sheet overspread the whole region, but then the ice and the streams under it continued the work that the lake-overflows had begun. Ice-streams doubtless crept through every valley in the region, whatever the relation of the valley's direction to that of the general movement, uniting, dividing, and uniting again until they reached the sea. The overflowing ice planed out the gorges which had been cut across the cols in the high-level valleys by the overflowing water. It ground the valleys down until their cross sections assumed the form of a shallow bowl, or deep bowl, or deep "U," according to local controlling conditions. Among these conditions were: the depth to which streams had already eroded trenches in the cols, and the relation between the direction of a valley and the direction of the chief glacial movement. The former condition would not only determine the form of a valley when the ice came upon it but also the thickness and weight of the glacier starting through it. The latter condition would determine the velocity of the ice movement. Two of the high-level valleys in the region which lie nearly at right angles to the general ice movement still retain the breaches in their cols; not sharply-cut gorges, to be sure, but narrow, ice-rounded troughs, as if the ice had at least been over the col but not in sufficient force to obliterate the gorge. If this much is true, it seems reasonable to go a step further and suppose that the amount of the discordance between many of the high-level valleys and the Sun is largely dependent on the relation between the weight and the direction of movement of the glaciers in the high-level valleys and the weight and direction of movement of the glacier in the Sun. It certainly seems probable that the Sun's floor began to break joint with the floors of its tributaries in this glacial stage of its development. It doubtless continued to sink below them even after the ice-sheet spread down to the sea, covering the entire surface, highlands and valleys alike, for the probable effect of the ice-sheet was to emphasize inequalities in the surface rather than to obliterate them. The weight being least on the highest surfaces, the ice probably did least erosion there. Being greatest in the deepest troughs, it probably did more erosion there. A trough already deep and parallel to the ice movement, like the Sun (parallelism as well as depth being a condition most favorable to the ice action), probably suffered the most intense glacial erosion.

When the ice retreat set in, the deepened western outlet by the Sun cañon came into play again. All the water in the region—a large quantity—drained out through it and doubtless deepened it a great deal. The insignificant streams once existing on the lines of the old high-level outlets returned, but did little excavating. They came tumbling down the wall of the new-made cañon in waterfalls, and perhaps cut short branch cañons of their own; but if they did, these were entirely obliterated by a second great glacier which, during another ice advance, ran through the Sun.

The cutting of the western Grö by stream erosion went on in much the same way as that of the Sun, and continued until the present Grö, or rather the Grö as it would be without the cañon in its floor, resulted. Probably about this time, or at any rate before the post-glacial cañon in the North fork was cut, water work again ceased throughout the system and another set of glaciers crept down to the sea.

This time a giant Sun glacier, formed by the confluence of smaller glaciers descending from the Op, the Gjeit and the Reppa, appeared and swept down past the mouths of the Op, the Grö and the Harem, with their pigmy glaciers. It is probable that these three valleys had not thus far broken joint with the Sun. But now, with the advantage already gained by the stream erosion plus the increased power of the glacier itself, the Sun glacier was able far to outdo all the little glaciers. It probably planed down the cañon's floor much deeper below the floors of the tributaries than the water had cut it. It certainly widened the cañon and steepened its side and end walls in a remarkable manner. When the ice departed, both side and end tributary valleys were left hanging high up on the Sun walls. The tributary streams when released all strove to trench. That of the South fork cut a long gorge, that of the Grö a short one, and those of the others none. The lake, still dammed by ice in the North fork, overflowed and cut the gorge described as reaching nearly back to Aune. When the lake disappeared, the Driv, instead of flowing down its old valley, found its way out through the gorge, thus completing the reversal of the Opdal system.

PORTO RICO: ITS TOPOGRAPHY AND ASPECTS.

BY

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The peace protocol had scarce been signed ere the American Government, with the energy and thirst for knowledge which characterises our people, commenced a scientific crusade against the oblivion which envelopes our knowledge of the resources of Porto Rico. The Smithsonian Institution sent expert collectors to gather information, especially articles for museum exhibit, illustrating the ethnology, anthropology, mineralogy and all historical, manufacturing and natural resources. The Fish Commission dispatched on the steamer *Fishhawk* an expedition composed of the flower of its scientific corps for the study and development of the fresh and salt water inhabitants of the island. The Coast Survey dispatched their steamer *Blake* to chart the coast and harbors of the island and the Geological Survey sent representatives of its most important branches to make a reconnaissance examination of those resources coming under its jurisdiction.

In company with Mr. Robert T. Hill, Geologist, I was thus afforded an opportunity of travelling, chiefly on horseback, throughout the interior of Porto Rico. Mr. Hill, probably the highest authority on West Indian geology, was assigned the duty of making a reconnaissance report on the geological and mineralogical resources of the island. I was assigned the duty of examining the interior, with the view to commencing a topographic survey, in addition to gathering data relative to the hydrography or water resources. We both paid considerable attention to the forestry and agriculture, and recorded our observations not only in note-books but in over 800 photographs taken in various portions of the interior.

We had scarce arrived in San Juan and presented our official letters to the Military Governor, General Henry, ere we were equipped with saddle animals and set forth on our first view of the interior. Certainly for us that first day's journey and those which succeeded it were days of discovery, though we had industriously read everything obtainable both in the Spanish and English languages relative to the island and though we were both thoroughly familiar through previous travel with the characteristics of many of

the West Indian islands and the neighboring Central American tropics. Nothing that has been written of Porto Rico conveys an adequate idea of the mildness of its semi-tropic climate, the fertility of its soil, the restful repose of its highly-cultivated scenery, and the liberality with which nature has showered her best gifts upon the latest and, I confidently believe, the most valuable addition to American territory.

Although situated in the Torrid Zone, between latitude 17° 54′ and 18° 30′ N. and longitude 65° 13′ and 67 ° 15′ W., the climate of Porto Rico is tempered by the first strength of the moisture-laden trade winds, because it is the eastern as well as the southernmost of the Great Antilles. Porto Rico is an island, the shores of which are bathed on the north by the waters of the Atlantic Ocean, on the south and east by those of the Caribbean Sea, and on the west by Mona Channel, which separates it from the island of Hayti. Its area is 3,670 square miles, or 1,200 square miles less than that of the State of Connecticut. Its average width is 35 miles and its length is—exclusive of Vieques and Culebra islands, which lie a few miles to its east, and of Mona Island, situated about 40 miles to its west—105 miles, or about the same length as Long Island, though it is twice as wide and nearly three times as great in area. Fourth in size of the Greater Antilles, it is roughly rectangular in form, its major axis lying almost exactly east and west, thus making it one of those few places which bear in nature an exact relation to our conventional ideas of north and south, and thus rendering it almost impossible for those of us who have difficulty in orienting ourselves to forget the cardinal points.

On November 16th, 1493, Columbus first landed on the west coast at what is now the port of Aguadilla, where he watered his ships at a spring from which a great volume still flows, and he is said to have named the island because of the richness of this port. The national Board on Geographic Names has officially decided that the name of this island is "Puerto Rico," because Puerto is the Spanish for port. There is no evidence, however, that *rich port* was the origin of the name of the island. The aboriginal inhabitants, who were of Arawak or Carib stock, were called by the early Spanish settlers "Borinquens," and the island was at first called "Borinquen." Later the Porto Ricans themselves took up the word Borinquen, which is to be found now printed upon numerous articles manufactured in the island as a trade-mark. It is the name common to the national air of Porto Rico, called the "Borinquena," and, as far as there is any direct evidence, the present name of the island is but a corruption of this confused with the symbolism of the word Puerto Rico into Porto Rico. At all events, as this is the way in which all English-speaking merchants and geographers spell the word, this seems to be sufficient evidence for our retention for that form of spelling which now has the official sanction of Congressional legislation.

This island should be to us of the greatest historic interest because of its richness in sacred relics of the days of Spanish discovery and conquest. It is the only portion of our domain which is identified with the discoveries of Columbus and the early Spanish explorers. The very spring at which Columbus obtained water for his ships is now protected by walls of masonry and is a fountain from which the nearby inhabitants obtain their water supply. Ponce de Leon landed in the Bay of San Juan fifteen years after Columbus made his first landing at Aguadilla and founded near there in 1510 the village of Pueblo Viejo. Here the ruins of his first house are to be seen, though his first reputed residence has long been claimed to be in the city of San Juan in the building called "Casa Blanca," which is now used as one of the administrative buildings of our military government.

The early Borinquens were ruled by caciques like our North American Indians, and were not dissimilar to them in appearance, though more sallow, with long, coarse, reddish-black hair. At first the early Spanish settlers lived on amicable terms with them, but after one or two uprisings they were practically exterminated in 1815, and it is now said that scarce a trace of the original full blood remains.

The peasantry of the country, called "Gibaros," are of decidedly mixed stock, Spanish blood evidently predominating; yet they show not uncommonly traces of Barb and Malay ancestry in their physiognomy, and I have seen a number who must have had a large percentage of Borinquen blood in their veins. They were a little darker and more copper-colored than the average Porto Rican, rather shorter of stature, and their heads were adorned with long, curled locks of coarse hair, reddish brown in color. There was no evidence of negro nor of Spaniard in their faces, and such few as have knowledge of the ethnology of the island with whom I talked agreed that they were of aboriginal stock.

The population of Porto Rico is 953,200, of whom 59,390 are said to be negroes and the remainder of mixed blood. These bald figures scarcely state the facts. The negro is rarely seen on the island. One never meets the West India negro as he is encountered in Jamaica, Barbadoes and Hayti. All the people of black skin who are encountered in Porto Rico have comparatively straight hair, and lack the broad nose and thick lips of the full-blooded negro. The negro problem is practically eliminated from the island of Porto Rico, and in this particular that island, like Cuba, differs from all others of the West Indies, where negroes predominate. Such black people as are encountered in Porto Rico are treated by their lighter-colored brethren as if their skins were of the same color. They intermarry and mix socially without any evidence of knowledge on the part of either that there is a difference in color between them.

The density of the population averages 225 per square mile, that of the eastern half of the island being greater than that of the western, and the average far in excess of that of any other of the Antilles. In fact, there are few portions of the United States where the density per square mile is so great. These figures of density do not give an adequate idea of the distribution of the population. The country region of Porto Rico is more completely inhabited and cultivated than almost any that I have seen. In this respect it compares favorably with our Mississippi Valley, Belgium and the Ganges Valley of India. From these it differs, however, in the fact that its population is not concentrated in cities of any size, but lives on small farms, either as private holdings or in peonage, and houses are to be seen scattered everywhere in the most inaccessible regions, on the steepest mountain sides, as in Switzerland, and in the depths of the most impassable ravines. The largest cities on the island are San Juan, with 32,048 inhabitants, and Ponce, with 27,952, the third in size being Mayaguez, on the west coast, with 15,187 inhabitants. In addition to these are dozens of smaller villages scattered everywhere throughout the interior and along the coast, at distances apart of fifteen to twenty-five miles, and containing from one thousand to six or seven thousand inhabitants. The remainder of the population is wholly agricultural and resides among the fields.

Let us now glance at the topography of this interesting island. From a scenic point of view it is one of the most beautiful of the tropic countries of the world. It is described by the Spaniards as "paradisiacal." They have always looked upon it as the most beautiful, fertile and delightful of their tropical possessions. In many places in the interior the scenery is superb, and is tempered with a melting loveliness of landscape by the numerous local rain-clouds, which give sufficient shadow to produce the softest effects.

This island is the easternmost of the Great Antilles. Its geology and geographic origin have been best outlined by Mr. Robert Hill in his book on Cuba and the West Indies; and as I had the pleasure of officially studying the island in his company, I may be pardoned for here using some of his modes of expression in describing the physical history of the West Indies as a whole.

This group of islands is in no manner related geographically or geologically to the continents of South or North America. The great Andean cordillera, extending north and south, approximately in longitude 70°, would, if projected on the same axis northward, pass near New York. This fact, that South America is projected so far eastward that its western coast is in the same longitude as the eastern coast of North America, is rarely appreciated. The axis of the coast ranges, as well as of the main cordillera, of the Rocky Mountains in the western United States running in a general northwestward and southeastward direction, would, if projected through Mexico, pass into the ocean to the southwestward of that country in the neighborhood of Mazatlan in longitude 105°, and if projected still further south would pass hundreds of miles to the westward of South America in the Pacific Ocean. The general trend of these two great cordilleran systems is north and south, or approximately at right angles to the general trend of the great Antillean mountain ranges, which is almost due east and west. There is, therefore, no topographic, as there has been found to be no geologic, relation between the Antillean mountains and those of the cordillera of North and South America. On the other hand, they appear to be closely related to the mountains of Central America, particularly those in the neighborhood of Costa Rica, Honduras and of Southern Mexico. These mountains have an eastern and western trend, and are of the same geologic time as those of the Antilles.

The island of Porto Rico is but the summit of a mighty mountain, rising at the highest point to about 4,000 feet above sea-level at the north coast, and descending thence abruptly into one of the deepest-known valley-bottoms—the Brownson Deep, but comparatively few miles to the north and 24,000 feet beneath the surface of the sea, thus making the mountain summits 28,000 feet in height above their base on the sea-bottom. On the south the slopes are continued to the bottom of the Tanner Deep, 15,000 feet below the sea-surface and at a relatively greater distance from the island.

The topographic configuration of this island and its surrounding deeps is reproduced on its surface. There is practically no coast plain separating the steep slopes of the mountains from the depths of the ocean. On the other hand, the slopes on the southern side of the island are more abrupt than those on its northern side. Parallel to the longest dimension of the island there is a central cordilleran system, which extends from the extreme northeastern end of the island near Fajardo to its southwestern extremity near Cabo Rojo. South of San Juan it is somewhat interrupted by a great, depressed drainage basin carrying the waters of the chief rivers of the island—the Rio Grande de Loisa and the Rio de la Plata, the headwaters of which have eroded the cordilleran summits backward to such an extent as to have forced the mass of the divide well toward the south coast in the neighborhood of Guayama. Eastward of this depressed area the main mountain range is known as the Sierra de Luquillo, which culminates near Fajardo in the highest peak upon the island, El Yunque, the elevation of which is stated by the Spanish authorities to be 1,520 metres, or about 4,940 feet; whereas its altitude, according to American authorities, is over 1,200 feet lower than this, or about 3,750 feet.

To the south of this depressed area, between Cayey and the coast near Guayama, the main range has the name of Sierra de Cayey, on which there are no summits of great altitude, the highest being about 3,000 feet above the sea, while the summits of the road-passes reach altitudes of 2,200 to 2,500 feet. West of Aibonito the central cordillera rises strongly, and is maintained unbroken to the extreme western end of the island, where the main spur reaches the coast in the neighborhood of Rincon, another pronounced spur disappearing in the sea to the south of Mayaguez. The second highest summit on the island is toward the western extremity of the central cordillera, immediately west of Adjuntas, and is called El Guilarte, the altitude of which is approximately 3,610 feet.

The summits of this cordilleran system are about one-third nearer the southern than the northern coast, the slopes falling away gradually into great, rugged mountain spurs to the northward and very abruptly to the low coastal plain to the southward. There is practically no coastal border on the north other than the alluvial playas, or back-coast border at the mouths of the rivers. These extend inland from two to three miles as fertile plains of triangular shape, the apex pointing up-stream and the base resting against the coast to either side of the river mouths. On the east and west the mountains reach the coast in much the same manner, falling abruptly into the sea between the river-beds, the only level land being in the stream-bottoms. On the south the main sierra falls away so precipitately that in a distance of from three to five miles the greatest difference of elevation between the highest summits and sea-level is passed.

As seen from the south there is a relatively wider coast border in places, almost a true coastal plain, which is the extension by erosion eastward and westward of the playas at the mouths of the various rivers. In addition, owing to the prominence on this coast of a subsidiary foothill system of low limestone hills, which reach down in many places to the coast border, there is a secondary drainage system at right angles to the main system, which flows from the cordilleran summits, and which separates them from the coast hills. This secondary drainage system has been eroded back in such manner as to frequently almost eradicate the coast hills, and thus has extended the coast plains for from five to seven miles back to the foot of the abrupt escarpment in which the main Sierra rises.

The general aspect of the island, as seen from the ocean, is mountainous, but not strikingly so. As seen from any point in the interior on the trails crossing the island, the aspect is that of an exceedingly rugged and broken mountain country; yet it is pleasing because of its high state of cultivation and of the many picturesque, peasant and plantation buildings which are to be seen in all directions. I can scarcely recall any portion of the United States as highly eroded as is almost every portion of the interior of Porto Rico. Here and there among the mountains are small flats and pretty little valleys, the most level and attractive of which are those seen on the main military road, on the headwaters of the Plata and Loisa Rivers about Caguas and Cayey, and at Sabana Grande, Del Palmar, etc.

The coast-line of Porto Rico is comparatively free of indentations or irregularities, and, unlike that of Cuba, has practically no good bays furnishing safe harborage. The harbor of San Juan is anything but an ideal one, owing to the difficulty of crossing a very dangerous bar at its entrance. The inner harbor is capacious and safe. One of the best natural harbors on the island is that of Guanica, similar in many respects to the best in Cuba, and that at which General Miles landed with his Porto Rican expedition. This is an unimproved harbor, however, and is not an important commercial port. The other good harbors of the island, like it, are scarcely used by ocean ships, as they are at some distance from cities of importance. These are the Puerto Real of Cabo Rojo, on the southwest coast, and Jobos, the best of all, on the southern coast. The harbors of Ponce and Mayaguez, the two most important commercial ports after San Juan, are both little more than open roadsteads.

Off the coast of Porto Rico are various islands belonging to its jurisdiction and now the territory of the United States. Most important among these are Vieques and Culebra, immediately to the eastward, the latter being almost half way from Porto Rico to Saint Thomas. So little has been known by us of these islands that it is interesting to observe that Culebra is as large as many of the more important of the other West Indian islands, having an area as great as the islands of Saint Thomas and San Juan and greater than that of many others of equal note. Vieques is at least twice the area of Culebra and is nearly as large as the island of Santa Cruz. The former of these is a comparatively barren and arid island of little agricultural value. On the other hand, Vieques is one of the most fertile spots in the West Indies, is highly cultivated, and produces wonderful crops, particularly of sugar cane. Between these and the main land of Porto Rico are several smaller islands of little moment. Just to the south of Ponce is a small island named Caja de Muertos, and close off the western coast is the island of Desecho; while still further west and about half way from Porto Rico to Hayti is the island of Mona, of little agricultural value, though covered with great deposits of valuable guano. In all there are about 20 islands of moderate size and many little rocks and reefs.

Owing to the comparative humidity of the climate, Porto Rico is unusually well watered. Flowing into the north coast are 12 rivers of considerable size; toward the west coast there are 4; toward the south 17, and toward the east 6. In addition to these there are over 1,300 smaller streams, which enter the ocean about the coastline, this great number being exclusive of the numerous large tributaries to the greater rivers which drain the interior. It will necessarily be realized that these rivers are of no great length; nor, as they drain relatively small areas, can they carry large volumes of water. Yet many of them, at low-water stage in the dry months of the winter, have water surfaces of from 100 to 200 feet in width near the coast, and the large portion of them are so deep as to be unfordable. This is particularly true of those rivers which flow to the north and west, those flowing to the south carrying much smaller volumes of water in the dry season and almost as much in the rainy season. There are no inland lakes on the island; but there are 8 small coastal lakes, the larger of which are those of Guanica, Arecibo and Cabo Rojo.

The geologic history of this island is simple. Below and bordering the ocean is a coastal series of recent and pleistocene age. It consists of horizontally-bedded strata of reef rock of coral origin separated by flat, alluvium playas, built up of sediment brought down by the various streams and aided in its accumulation by the encroachment of mangrove growth into the sea-water. Above this coastal series, and practically horizontally stratified beneath it, though at a greater altitude, are the older oceanic series of middle and later tertiary age. This consists chiefly of white limestone, produced in deep sea. This is of foraminiferal origin, and includes great masses of radiolarian earths. This oceanic series forms the larger part of the lower coast ridges on the north side of the island and of the coastal ranges and isolated summits on the southern border of the island. Above these in altitude and below them in geologic time is the third series, called by Hill the "Blue Mountain series." This is of latest cretaceous and eocene time, with, perhaps, some older basement rocks of volcanic origin, mixed and interspersed with streaks or masses of blue limestone of submarine origin. The limestone appears to have formed at the same time that volcanic action was most powerful, as it has volcanic rocks interstratified and mixed throughout its mass. This older series includes not only volcanic rocks but also their water-worn detritus. It is mostly porphyritic and gneissic, and in general appearance this mass of rocks is greyish-blue or slate-colored, which color has turned to brown and reddish tints, wherever it has been weathered, because of the iron contained in it.

Porto Rico is poor in minerals of economic value, both in quality and variety. A little gold is found as stream deposits in the foothills of the mountains southeast of San Juan, where a few inhabitants make a precarious living by washing the stream sands. These are of such richness as is called in California "pay dirt," by which is meant gravel which will earn wages and nothing more. Toward the extreme western end of the island, in the neighborhood of San Sebastian, are a few deposits of fairly good lignite, of doubtful commercial value because of the smallness of the quantity and the poorness of the quality. As a fuel it must rank far below the poorer grades of bituminous coal. Elsewhere are small deposits of phosphates, as guano, on Mona Island especially, and there are abundant deposits of green sand marl, rich in phosphates, which should in the future furnish sufficient fertilizers at least for the use of the island. Of iron there appears to be little of value; nor are there evidences of other minerals in merchantable quantities. A good brick clay is generally distributed throughout the island, and there is abundance of good limestone from which to make high-grade mortar and perhaps cement. Several brickyards and limekilns are in operation in various portions of the island.

Climatically, the island may be divided into two distinct parts—the northern, which is humid, and the southern, which is semi-humid, bordering almost on arid. According to Professor Mark Harrington, ex-Chief of our National Weather Bureau, and recently in charge of the Division of Climatology of the West Indies, the rainfall is almost as diverse as in the United States. The southwestern portion of the island, near Cabo Rojo, was for one period of about three years without a drop of rainfall. At the opposite extremity of the island, the northeast end under El Yunque mountain, the average annual rainfall is 123 inches. At San Juan the average precipitation for 20 years has been 54 inches, considerably greater than at New York or Washington, where it averages about 45 inches. At Guayama, directly south of San Juan, not a drop of rain fell in 1893; yet in other years heavy tropic showers fall annually during the rainy season of from 6 to 8 inches in 24 hours. These are rainfalls of unprecedented amount in so short a period of time. Extreme rainfalls recorded in various parts of the island have been as great as an inch an hour for two to three hours. These storms occur suddenly during the rainy season all over the island, and even in the dry season on the north side of the island, at several intervals in each day. Everyone carries an umbrella and a mackintosh in San Juan, even in winter, and out of a bright sky, absolutely cloudless, there will suddenly fall, for ten to fifteen minutes, as heavy a shower as we would expect to encounter in the United States during the summer months.

The climatological transition from one side of the island to the other is clearly evidenced in the vegetation. On the north side the humidity of the climate is witnessed everywhere in the dense tropic verdure, the magnitude of streams but a few miles in length, and in the perpetual wet and muddy condition of the roads and trails. Immediately after crossing the main summit of the cordillera the grass on the southern slope is observed to be yellow and dry as that of Texas or the western Kansas plains. In many places the vegetation is entirely similar in every aspect to that of Western Texas and of Arizona; the hillsides are covered with dry grass, and acacia, yucca, cactus and other arid plants abound, none of which are to be found on the north coast. One must not reason, however, from this that it is a truly arid country. Its most arid aspect is witnessed only during the dry season. During the summer, or rainy season, there is sufficient precipitation, excepting in a few localities and in unusual seasons, to render it possible to cultivate many valuable crops. Only in a few scattered localities is it necessary to irrigate, and then only the sugar cane. West of Ponce, and between that city and Mayaguez, is practically the only portion of the island so arid that one finds great fields of our Indian corn, of beans, pineapples and similar semi-arid tropic crops.

The great relative humidity of the north coast of Porto Rico, as well as the remarkably uniform and mild temperature of the entire island, are due chiefly to the trade-winds, which blow with great force from the northeast all the year round. These winds temper the climate and, striking against the high summits, are condensed and deposit their moisture. Passing over these they are more dry, and the farther to the westward they advance through the Caribbean Sea, toward Central America, the less humid and the warmer are these trade-winds. It will thus be realized that because of its vantage point as the extreme eastern of the Great Antilles, Porto Rico derives a climatic benefit from these winds which is possessed by none other of those islands. It is more moist and, therefore, more fertile than Santo Domingo, and still more so than Cuba, and its temperature is less high and more uniform than that of either of the latter islands.

The average daily temperature on the island, taken year in and year out, is 80 degrees, and this is ameliorated by the cooling north breeze which prevails even in the hottest days. The maximum heat ever recorded, and this only on three occasions, has been 99 degrees, and the minimum 70 degrees. In the hottest weather the thermometer frequently records 90 degrees, but rarely more, and falls as low as 75 to 80 degrees at night. During the entire winter, or dry season, the thermometer rarely records more than 75 degrees, nor does it fall much below 65 degrees, except in unusual days. The hottest months are from June to September, and the coolest from December to February. The wettest are from September to November, and the dryest from January to March. The mean monthly temperature of Porto Rico hardly varies 10 degrees throughout the year, the extreme recorded limits being 40 degrees instead of over 100 degrees as in New York. It is a rare thing when one cannot sleep comfortably at night—an occurrence not so infrequent in our own country.

The soil of Porto Rico is of remarkable fertility, due to its origin in the disintegration of coral limestone and the basic igneous rocks. Where coffee is cultivated the soil is a dense red, greasy clay, the result of decomposition of the underlying volcanic rock, and fertilized by a thick covering of black vegetable mould. In all the river valleys which border the island at frequent intervals, sugar is practically the sole agricultural product. In the lower foot hills, which rise gently from the river bottoms and the coast border, there is a dense growth on the moist or northern coast of guinea grass, which furnishes excellent forage, and on the southern or more arid coast of other varieties of grass, which luxuriate naturally and furnish great fields in which are pastured herds of cattle.

In addition to the sugar grown on the coast plains, tobacco is raised in great quantities on the lower northern slopes, and is of the first quality. From it a grade of cigars and cigarettes is made equal almost to the best exported from Havana, and containing much of the bouquet for which Pinar del Rio tobacco is noted. It is not an unusual sight to see hundreds of acres of the steepest mountain slopes intensely cultivated with tobacco, not a weed in sight, and groups of laborers, ten to twenty in a group, clinging like ants to the hillsides, hoeing or gathering the product. A variety of cotton of long staple and fine fibre grows wild and on bushes as large as peach trees—so large, in fact, that it took some time for me to realize that these were truly cotton plants and not some allied tree. Yet, for some unaccountable reason, the Spaniards have never encouraged the cultivation of cotton, and little or none is grown. Porto Rico is also noted for a variety of upland or mountain rice of excellent flavor, but rather darker in color than those varieties which are in favor in European markets. Yet rice is but little cultivated at present, though at one time great quantities were produced. The chief reason for the decadence of its cultivation has been its discouragement by the Spanish Government in order that the rice of Spain might be exported to Porto Rico.

As I have already intimated, coffee is the staple product of the island, grown universally above an altitude of twelve hundred feet; and as it is more luxuriant, the crop larger and the quality better the higher up it is grown, the most rugged mountain summits are planted with this valuable bush. As the coffee plant is delicate and requires to be protected from the sun, it is always grown under the shade of some tree, as the guava, guama or banana.

In addition to the above the interior of the island produces all the vegetables of the tropic and temperate zones, including tomatoes, potatoes, yams, peas, sweet potatoes, etc. These are displayed each morning in the markets, as are also all the tropical fruits, including oranges of many varieties and of good flavor, bananas, pineapples, the latter especially in the southwestern portion of the island, aguacate, guava, limes, etc.

The flora is varied and beautiful; great masses of marguerites, sweet peas and single poppies of large flower and brilliant coloring illuminate the slopes, as do the white and yellow daisy the fields of our own country. Many of the more beautiful of our hothouse or cultivated flowers grow wild; among them hydrangeas, hollyhocks, numerous brilliant-colored begonias and the coleus. Much of the coloring in the foliage, however, is produced by colored leaves, not only of plants but of trees, which give the effect of flowers. The most brilliant of these is the poinsettia, a gorgeous cardinal leaf several inches in length, and the flamboya, a tree of the acacia variety, which is densely covered with small flowers similar in general appearance to the locust, but of radiant vermilion color; and also the clematis, hibiscus and magnolia. Ferns of all varieties, sizes and shapes, up to those of the fern tree, make a literal jungle of the more shady slopes. Beautiful mosses and numerous orchids abound on the rocks and as parasites upon the trees.

Among the indigenous trees, a few of which still exist in the forest, but scarcely in merchantable quantities, are ebony, mahogany, lignum-vitae, ironwood, rosewood and Spanish cedar. The latter is used extensively in making cigar boxes, and also in trimming the interior of such private residences as can afford the expenditure of such rare wood. Mahogany is one of the most abundantly used of woods, being employed for all the more common structures, as fence-posts, sills, uprights, scantling and roof timbers for dwelling-houses, and the bodies, wheels and other parts of carts. There are twenty-eight varieties of medicinal plants, including about twelve which furnish condiments, twelve which furnish dyes and tanning materials, and eight resinous trees. These include gum copal, guaiacum and similar products, which are extensively exported.

Porto Rico is exceedingly poor in indigenous fauna, not only of animals, but of birds and fishes. The largest native quadrupeds are an agouti and an armadillo, both of which are so rare as to be practically extinct. Next in size and most abundant in numbers are the common rat, found chiefly about cities and wharves; also some ground squirrels and similar animals. There are scarcely any reptiles, and none of poisonous variety. Food fishes are exceedingly rare in the waters of the interior and in those surrounding the island. Small song-birds of brilliant plumage are fairly numerous, but large birds of any kind, including parrots, are comparatively rare. Even poisonous insects are relatively less numerous and troublesome than in many other tropic countries, although there are a sufficient number of these to torment the unacclimated stranger.

The cattle of Porto Rico are a most interesting sight to one acquainted with the dwarfed animals which are found on other West Indian islands, in Central America and our southern States. The Porto Rican cattle are of Andalusian extraction; are large, heavy animals, with great, wide-spreading horns, and with proper care and with discrimination in the selection of those to be slaughtered they will furnish one of the most valuable products of the island. At present quantities of them are exported to neighboring islands. On the other hand, the horses and mules of Porto Rico are as disproportionately small as the cattle are large. They are not much larger than Shetland ponies, yet they are so sure-footed and so powerful that they bear burdens and make journeys which would put to shame many of the larger animals of which we are so proud. The average burden for the laden pack mule in the western United States is from 200 to 300 pounds, yet it is a common sight to see trains of these little ponies and mules laden with 200 pounds of coffee, which they carry with apparent ease over the most rugged trails that it has been my fortune to encounter. Harnessed to the little landaus which are popularly used in the cities of Porto Rico and on the main military road crossing the island from San Juan to Ponce, these tough little beasts never descend to a gait slower than a fast trot, and rarely take one slower than a gallop. Thus they race with the mail and passenger coaches up and down hill over the finely macadamized military road, covering regularly the distance of eighty miles from San Juan to Ponce in twenty-one hours, including numerous stops for relays and for meals.

This is essentially the land of the small farmer; it is the only one of the West Indian Islands where agriculture is so diversified that sufficient food is produced for the sustenance of the inhabitants. There are about 1,100 of the larger sugar, coffee and tobacco plantations, but the great proportion of the island is cultivated in individual holdings, of which there are about 21,000. Of these, 13,000 are devoted to the cultivation of small fruits and vegetables, and about 4,000 each are devoted to miscellaneous crops, and to fruits and coffee.

Next after Spain and Cuba the United States ranks about equal with England and Germany in commerce with the island of Porto Rico. The exports to Spain in 1895 were about $5,800,000, and to the United States $1,800,000. The imports from Spain in the same year were $8,600,000, and from the United States $1,500,000. These are the figures published in Consular Reports and in the Commercial Statistics published in the island of Porto Rico. There is no evidence of the above extensive importations from the United States to be found in an inspection of the wholesale or retail establishments of the island other than in the large quantities of corrugated iron used for roofing, of pine lumber and of kerosene oil. All of the dress goods, notions, and smaller manufactured articles sold in the retail stores in the cities are of Spanish or German manufacture. I was especially discouraged upon purchasing an attractive olla, or water jar, of particularly characteristic Latin-American design, to find a printed label on its under side upon which were the words "Made in Germany." Yet in those words is the key to German supremacy in the small mercantile trade of Spanish America. Our manufacturers insist on sending to such countries a type of goods and products which they are accustomed to make and sell in our country, and seem determined to force these upon the inhabitants of another clime. The German invariably finds out what the people with whom he has to deal use and desire, and he makes goods of the material and pattern to which they are accustomed.

The principal articles of export are coffee, $8,790,000; sugar, $3,750,000; tobacco, $645,000; honey, $520,000. The chief articles of import are rice from Spain, $2,180,000; fish, in the form of codfish from Nova Scotia, the chief food article of the gibaros, $1,890,000; meat and lard, $200,000; and flour, $980,000.

Transportation on the island is of the most unsatisfactory kind. There are about 140 miles of French railroad, of narrow gauge, cheap construction and slow operation. This is a portion of the system of railways planned to girdle the island, less than half of which has yet been constructed. There can scarcely be said to exist any roads upon the island outside of the military roads, that feature of the transportation having been well cared for, while the comfort and needs of the inhabitants have been entirely neglected. The roads are divided into three classes. Of the first class, or military roads, there are 285 miles, of which 80 miles cross the island from San Juan to Ponce, and the remainder are scattered about the coast. These are of the very best class of macadam construction. The road surface is kept in good repair under the American administration, following the Spanish system, by road laborers, each of whom has but a mile or less of highway to care for. All streams are passed on substantial masonry or iron bridges and culverts, and the grades are of the best.

In addition there are said to be about 550 miles of second-class or cart roads. None of these are of such quality as would be considered passable in our country. They are dirt roads, originally fairly well constructed, but never repaired. As a result, owing to the great amount of moisture, they have been so cut up as to be practically impassable even to two-wheeled bullock carts, much less by four-wheeled vehicles. It is not an unusual sight to see a coffee-planter sending less than a quarter of a ton on one of these carts as a load, and hauled by at least ten to fourteen bullocks, which are scarcely able to drag it through the axle-deep mud. Finally, trails passable only by the sure-footed native ponies ramify everywhere throughout the island, climbing the most precipitous summits or descending into the deepest ravines and leading to all fields and residences. Over these the bulk of the trade of the island is carried by pack animals. Communication is well established throughout the island by a number of postal routes, with post offices now managed as branches of the Washington City post office in all the cities of 1,000 inhabitants and upward, and there are between 470 and 500 miles of telegraph line reaching also to all principal cities and operated under Government control.

The gibaros, or peasantry of Porto Rico, have been aptly described as like the peasantry of Ireland—proverbial for their hospitality, light-hearted and happy, and yet ready to fight on the slightest provocation. They swing all day in the shade of a banana or orange tree in their hammocks, smoking cigarettes or cigars, picking the *tiple* or small native guitar to time scraped with a piece of wire on the roughened surface of a calabash; this instrument, the guitarra, being the national instrument, and found in almost every house on the island. The plantain or palm grove which shades the house, the coffee bushes and tobacco plants, all of which grow almost without cultivation, afford sufficient though frugal sustenance. A few gamecocks and a couple of pigs tethered by strings, a machete and a few earthen pots, form the extent of their movable property. When it is necessary to procure anything else they mount their little ponies, straddle the panier baskets laden with coffee and plantains, and with their machetes in their hands and dressed in a white cotton shirt and pantaloons, not dissimilar to pajamas, they proceed to town for the purpose of trade.

Of the cities San Juan is the only one which is fortified. Its chief fortifications consist of Morro Castle, commenced in 1534 and standing to-day much as when finally completed in 1584. It is a magnificent and picturesque pile of masonry, descending from the extreme height of the Island of San Juan to the water edge, and against which the ocean waves incessantly thunder. In addition and at a little distance is the fortress of San Cristóbal, built in 1751, a massive structure standing well to the rear of the city in such manner as to defend the city walls, of masonry like the Morro, and even more brilliantly colored with the crude Moorish pigments which lend such splendid effects to the remaining buildings in the city.

Ponce is essentially the commercial city of Porto Rico. It is one of the principal shipping ports for sugar and coffee, and the Playa, which is the seaport of Ponce and situated about three miles from it, though the main road between the two is well built up, is by far the busiest shipping port.

Mayaguez, the third city in importance, is essentially the residential city. It has a fair business both with the interior and through export and import trade, but for its private residences it is especially notable. Like Ponce, Mayaguez is a couple of miles back from the ocean front, with which it is connected by a well-built thoroughfare leading to the playa or port, a small commercial suburb of great activity.

The home life of the Americans now residing in Mayaguez is most agreeable. The city is clean, well paved, its sanitation is the best on the island, as well as its water supply. The private houses of the residents are beautifully constructed, and the better class of people are not so absorbed in business as to reside over their stores, as they do in San Juan and Ponce, but have comfortable homes separate from the business quarter. They have treated the American officers and their wives more cordially than elsewhere, and there is a delightful social intercourse between the two, which makes Mayaguez, if for no other reason, the most attractive city for Americans. For various other reasons, however, Mayaguez impressed me as one of the most pleasing tropical cities I have seen and one which is destined in the future to be a great winter resort for our people.

San Juan is far less attractive because of the great rainfall, which renders it almost impossible to go out in the streets without certainty of being wetted before one can return. Ponce, on the other hand, is too busy and too much absorbed in commercial affairs to give promise of being one of the future residential cities. Scattered elsewhere throughout the interior of Porto Rico are numerous cities of even as few inhabitants as 1,000 persons which will frequently put to shame our own villages of equal proportions. They are generally fairly well paved with cobblestones or macadam. They are provided with delightful public squares or plazas. They have good sikewalks and are lighted with lamps or by electricity. The better class live in substantial masonry residences, not infrequently in the second floors above the business houses. This, however, is largely for sanitary reasons, as owing to the perpetual moisture of the ground, all structures, even those of the poorest peasantry, are raised somewhat above the ground surface, and wherever practicable they are supported on pillars allowing passage for air beneath the living rooms.

In general the sanitary condition of the cities of Porto Rico is far worse than it should be, yet not as bad as that of the cities of Cuba and of many other tropical regions and of many of our own southern towns. In no city, even the largest, is there an underground system of sewage. There is always excellent surface drainage, due to the steep grades found everywhere. The streets are now, especially under American régime, fairly clean, and the garbage is removed, though the liquid refuse of the house is always discharged into cesspools in the courtyards, which in the past have not been cleaned as frequently as they should be. The water supply is about equally divided between that obtained from rainfall, in which case it is so often replenished by the clouds as to be fairly pure and wholesome, and that obtained from running streams. The stream water is most dangerous to the stranger and should never be taken without boiling. All of the water consumed on the island is filtered through porous earthern jars, which give it a clear and limpid appearance, even though it may be contaminated from bad sewage or other causes.

The city of San Juan is located on a small island but three miles in length, its maximum width being scarcely a mile. It is compactly built, laid out on a rectangular system, six streets running east and west and seven north and south. The streets are narrow and the houses two and three stories in height and all of substantial masonry, covered with a smooth surface of plaster and most picturesquely decorated in flat tints of white, brown, yellow, blue, purple, green, pink and vermilion. The result is oriental and picturesque in the extreme. Never has it been my good fortune to gaze upon a more inspiring and artistic spectacle than that witnessed in the early morning as our ship crossed the bar to San Juan harbor. On the west rose precipitously from the water's edge the massive sea wall, crowned by the ponderous battlements of Morro Castle. In front and to the right opened out the broad expanse of the inner harbor dotted with picturesque shipping, set in a background of low, green palm-covered shores and distant blue hills. Between the two and rapidly unfolding as we passed the point of the Morro, there rose on the left tier above tier to the highest summit of the little island, one building apparently on top of the other, until the city was disclosed in a series of many-colored walls and terraces, crowned by the frowning heights of San Cristóbal.

PHYSIOGRAPHIC NOTES.

BY

RALPH S. TARR.

THE SHAPE OF THE EARTH.—When William Lowthian Green published his *Vestiges of the Molten Globe*, it attracted practically no attention, and nearly all who gave it any consideration looked upon it as a vague speculation. In England and America his theory has, until within the last year or two, been neglected; but once people began to study it with seriousness, it has been interesting to watch the respectful attention which his theory has received. Gregory's paper, in the *Geographical Journal*, has already been abstracted in these notes. (See Bull. Amer. Geographical Society, Vol. XXVI, 1899, p. 259.)

Now Professor Emerson presents a consideration of the Tetrahedral theory in his address as President of the Geological Society of America. (*Bulletin Geo. Soc.*, Vol. XI, 1900, pp. 61–106.) As a whole, Emerson seems to favor the hypothesis proposed by Green. He considers with Green that this tetrahedral theory accounts for the triangular shape of the continents pointing southward, and of the oceans pointing northward, and that it also accounts for the fact that in general the land is antipodal to the water.

One of the difficulties which Green encounters in his attempt to explain the larger earth-forms is the fact that the southern continents are not in exactly the position that they should be upon the theory. Moreover, between the southern and northern continents is a zone of depression and of mountain-folding, represented by the West Indies, the Gulf of Mexico, and the zone of disturbance in the neighborhood of the Mediterranean and, east of this, in the neighborhood of Southern Asia. This "zone of intercontinental seas" serves Emerson with an opportunity for considerable discussion. Green accounts for it as being a plane of weakness along which a shifting took place, as along the twinning plane of a crystal, with the result of throwing the southern continents out of line. Emerson suggests the alternate speculation, that when formed the zone of fracture was in reality the equatorial zone In the course of further cooling of the globe the equator and pole were shifted to their present position.

It is impossible in a brief space properly to summarise Emerson's paper, but any one interested in speculation concerning the origin of earth-form will find here much food for thought.

ANCIENT GLACIERS IN THE SIERRA COSTA OF CALIFORNIA.—Little by little we are gaining information concerning the form of glaciation in the mountains of the West. A recent paper by Hershey (*Journal of Geology*, VIII, 1900, pp. 48–57) describes the evidences of individual glaciers among the Sierra Costa mountains of northwestern California. Aside from his description of the evidences of glaciation, there are one or two points worthy of note. He finds that the valleys which were occupied by the ice show distinct signs of their occupation in several ways. The talus material has been removed from the valley sides. The valleys have been smoothed and given rounded slopes, with gently rounded floors, thus becoming U-shaped. In the course of this glacial erosion many of the side ravines have been destroyed, partly by grinding back, partly by deposit in the valleys.

At first Hershey thought he had found signs of two glacial epochs, one much older than the other; but further study has led him to the conclusion that this evidence is not valid. The deposits near the end of the glaciated valleys are slightly older in appearance than those near the heads of the valleys. It is a question that has often arisen in my own mind whether a considerable amount of the so-called ancient drift of the first glacial epoch is not in reality material of residual decay pushed to the edge of the ice during its earliest advance.

In Hershey's opinion an elevation of three thousand feet would be sufficient at present to cause reduplication of the ancient glaciers, and he seems inclined towards the belief that this is the only explanation of the glaciation of this region.

EVIDENCE OF GLACIAL EROSION OF LOCH LOCHY, SCOTLAND.—While for a number of years glacial geologists have been rather averse to the admission that glaciers have done distinctly important work in erosion, it is interesting to note that there seems now a tendency in many directions to accept the evidence—which is very clear—that the glaciers have eroded certain surfaces very perceptibly. Blanford (*Quarterly Journal*, *Geological Society*, LVI, 1900, pp. 108–204) calls attention to the evidence of glacial erosion which he has noticed in Loch Lochy. The valley side is a sloping plain, and the tributary valleys to this, which are quite pronounced higher up on the hill-side, are entirely absent near the base of the hill-slope. Blanford's explanation of this condition is that the passage of the ice through the valley planed back the hill-slope so far that the tributary valleys were erased near their lower ends. Something of this same sort may also be noticed in the longitudinal valleys of central New York, as, for instance, the valley of Lake Cayuga; but here, while lateral erosion has doubtless been one cause, valley-deepening has certainly been an even more important cause for the peculiarity which Blanford describes. (See Tarr, *Bull. Geol. Society Amer.*, V, 1894, p. 339.)

Another point of importance in Blanford's brief paper is his consideration of the evidence furnished by the small lateral gullies which have been eroded in the glacial deposit that veneers the hill-side. These, he points out, are entirely post-glacial. They are quite pronounced. And it would be a simple matter for careful study to use their present rate of erosion in making an estimate of the time since the ice withdrew. Blanford is impressed by the fact that these gullies cannot have required a very long time for their formation. His own conclusion is that which many others have adopted from evidence elsewhere—that an estimate of 10,000 years is probably nearer the truth than the longer estimates for post-glacial time of some of the workers.

It is to be noted that while an estimate of the present rate of erosion, as proposed by Blanford, will, of course, be of value, it could not be taken as an exact basis for a conclusion as to the number of years since the glacial period, because there are modifying factors. During the greater part of the time since the glacial period these hill-slopes have had the protection of vegetation, now removed. Moreover, the amount of water supplied by the melting of the ice and snow, and possibly even by heavier rainfall, may have been much greater at an earlier time than now.

NOTES ON CLIMATOLOGY.

BY

ROBERT DeC. WARD.

The Climate of San Francisco.—San Francisco has, in some respects, one of the most interesting climates in the United States, the most striking feature being the delay of the maximum monthly mean temperature beyond the middle of the summer into September. This results from the fact that the city lies at an opening in the coast range of mountains, through which there is a strong indraft of air from the Pacific towards the interior valley, while the latter is most warmed under the summer sun. This strong onshore wind prevents the temperature at San Francisco from reaching a maximum in midsummer, as is usually the case. The maximum monthly mean temperature is displaced into September, when the interior valley is less warmed, and when, therefore, the onshore wind at San Francisco is less strong, and its cooling effect less marked. *The climate of San Francisco* has been made the subject of a recent *Bulletin* (No. 28) of the United States Weather Bureau, prepared by A. G. McAdie, Local Forecast Official at San Francisco, and G. H. Willson. The rainfall data used in this discussion go back to 1849, while the temperature and other records begin in 1871. The Bulletin is chiefly made up of tabular matter, the discussion being limited to three pages out of 25. One could have wished for something in the way of a description of the seasonal weather types which go to make up the climate of San Francisco. Tables of climatic data, while of great importance, are dry and unattractive, and really convey little meaning to the average reader. The mean annual temperature of San Francisco is 56.2°. The warmest month is September, with 60.9°; the coldest month is January, with 50.1°. The highest temperature on record is 100°, which was noted on June 29, 1891, and the lowest was 29°, on January 15, 1888. The annual rainfall is 23 inches. July and August are practically without rain, while December and January together have nearly 10 inches. The crop yield is largest when, other things being equal, rain falls generously in March and April.

Relative Humidity as an Element of Climate.—The importance of relative humidity in determining, together with temperature, the degree of comfort or discomfort that is felt under different weather conditions, is a matter that is coming to be more and more recognized and discussed. Lancaster has recently published a paper in this connection, entitled *De la Manière d'utiliser les Observations hygrométriques* (Rapport lu au Vme Congrès International d'Hydrologie, de Climatologie et de Géologie médicales à Liège, 1898). As a result of a long series of personal observations made in Belgium, the author concludes that the heat there becomes very oppressive when, the temperature being about 86° F., the relative humidity reaches 40%. For lower temperatures the heat becomes very oppressive when the relative humidity rises above the following percentages for the given temperatures:

Temperature.......	84°	82.5°	80.5°–77°	75°–73.5°	71.5°–70°
Relative Humidity..	45%	50%	65%	70%	75%

In the case of Vivi, in the Congo Free State, the mean relative humidity with a temperature of 86° is 59%. In Belgium, the relative humidity, with that same temperature, averages 36%, and personal experience shows that if the relative humidity in Belgium rises to 40%, with a temperature of 86°, the heat is almost unbearable. This sort of investigation can readily be undertaken by any one, and offers opportunity for obtaining most interesting results.

KÖPPEN'S KLIMALEHRE.—One of the most useful little publications in the field of climatology is *Klimalehre*, by Dr. W. Köppen, of the Deutsche Seewarte, in Hamburg. (Leipzig, Sammlung Göschen, 1899. Small 8vo, pp. 122. Price 80 pfgs.) Hann's *Handbuch der Klimatologie*, a second edition of which, in three volumes, was issued in 1897, has been, since the publication of the first edition in 1883, and will for years remain, the standard publication on climatology. But Köppen's little book, with its small size and low price, will certainly make a place for itself. It sets forth the principles of climatology clearly and systematically, and will serve admirably for those who, having a good general knowledge of meteorology, wish to learn something of climatology as well. While all the chapters in the book are models of what a competent author can do in a very limited space, the last chapter is perhaps the best of all in this respect. In this chapter of 17 pages we are given an admirable discussion of the five climatic zones, the characteristics of each of these zones, and a suggestive, though necessarily very short, account of the relation of the zones to civilization.

LOSS OF LIFE BY LIGHTNING IN 1899.—Thunderstorms are one of the characteristic climatic phenomena of the United States, and the damage that is done by lightning is therefore a perfectly legitimate subject for comment in these NOTES. During the year 1899, 562 persons were killed outright by lightning in the United States, or else suffered injuries which resulted in death, as reported by Professor A. J. Henry in the *Monthly Weather Review* for March. The number of persons who received injuries varying in severity from slight physical shock to painful burns was 820. This loss of human life by lightning during the past year was greater than for any preceding year for which statistics have been collected. The greatest number of fatalities (45%) occurred in the open; the next greatest number (34%) occurred in houses; 11% occurred under trees, and 9% in barns.

THE EFFECT OF SEASONS UPON RAILROAD BUILDING IN ECUADOR.—The Government of Ecuador has lately granted a concession for the building of a railroad from Guayaquil to Quito, the capital of Ecuador. The latter city has hitherto been reached only by mule or horseback. There are many difficulties of construction to be encountered, but the building of the railroad is also much delayed by the rainy season. According to "El Progreso de Quito," as quoted in the *Bulletin of the Bureau of American Republics* for April, work on this road will not be carried on actively during the rainy season, owing to the fact that the majority of native laborers object to engaging in outdoor work during the winter, when they are exposed to torrential rains, and when, furthermore, the low temperatures in the Cordilleras are keenly felt.

THE WEATHER AND THE PRICE OF WHEAT.—Mr. R. C. Mossman, of Edinburgh, has recently published a paper on *The Price of Wheat at Haddington from 1627 to 1897*, which was read before the Scottish Society of Economists. The investigation is an interesting one, and brings to light some rather striking facts. The most extraordinary prices were in 1800 and 1812, heavy rains and a low August temperature being the chief causes in the first case. The high price in 1812 was due to a deficiency of the crop of 1811, without the means of obtaining any wheat from abroad. In 1879 there was a rise in price, which was the result of the extraordinary severity of the weather; and in 1891 the rise was due to a severe rye famine in Russia, and to the supply in the two preceding years being inadequate to meet the demand.

MR. H. L. BRIDGMAN ON PEARY'S WORK.

Secretary Herbert L. Bridgman, of the Peary Arctic Club, addressed the Society, at its first meeting in Mendelssohn Hall, on Tuesday, April 17, on "Peary's Work in the Arctic in 1898–99 and 1900." Mr. Bridgman, who was in command of the *Diana* Expedition of 1899, spoke without notes and showed many lantern illustrations, some from photographs by Mr. Peary, and developed from plates sent home by him, and others from the camera of Prof. William Libbey, foreign corresponding secretary of the Society, and leader of the Princeton Scientific party on the *Diana*. Many of Mr. Peary's views were of his new discoveries in Grinnell Land and illustrated topography and localities never before seen by man. The lecture was of a familiar and informal character, more a personal narrative than a scientific or geographic paper, and may be satisfactorily summarized in the following unpublished report of Mr. Bridgman to the Peary Club on his return from the North in September, 1899:

The Club's chartered steamer *Diana*, Capt. S. W. Bartlett, left St. Johns, N. F., July 15, arriving at Sydney, C. B., July 17. Coal, the generous gift of the Dominion Coal Company, and provisions having been taken on board, the steamer left Sydney for the North at 4.30 Friday, July 21, one day later than the date appointed by Mr. Peary in his memorandum from Etah, Aug. 12, 1898. Our northern course was almost a duplicate of his letter. Letters were mailed at Domino Run, Labrador, Tuesday, July 25; the Labrador ice-sheet of seventy-five or eighty miles traversed during that night and the following day required about fourteen hours, the Greenland coast was sighted near Sukkertoppen, Friday, July 28, and at 8 on the evening of the 30th anchor was dropped at Disco.

An immediate call on Gov. Olsen, to whom our credentials from the Department of State were presented, disclosed the fact that no news had been received of Peary or the *Windward*. Gov. and Mrs. Olsen, with their two sons, returned our call the next morning; and in ten minutes after they had left the *Diana* she was under way via the Waigat for the North.

Upernavik was reached at 7 Tuesday afternoon, Aug. 1, and having exchanged official courtesies with Gov. Krauth, who had no news of Peary or the *Windward*, and delivering to him parcels from Gov. Olsen, with less than two hours' detention, we were again on our course. Melville Bay was crossed in twenty and one-half hours, the shortest time on record, and Cape York and the southernmost native settlement reached at 9 Thursday morning, Aug. 3. Here we gathered from the natives that the *Windward* had wintered somewhere on the Grinnell Land coast, and at the next settlement, Saunders Island, fifty miles north, reached at 9 that evening, a native delivered the following note, in pencil, on a half sheet of note-paper, enclosed in a pasteboard envelope fifteen inches long and two wide:

Captain, Peary Auxiliary Steamer:

"You will find a note in pole on top of Littleton Island. April , 1899. PEARY."

The natives also made us understand that Peary had met with an accident to his feet, and that they had subsequently seen him walking and getting about as usual. Full speed was rung for Littleton Island and ten natives were taken on board for any service—hunting or other—which they might render. As we were passing the entrance of Foulke Fiord, Friday, Aug. 4, at 3 P. M., one of the natives on the bridge made the officer understand that there were people and possibly letters at Etah, six miles up the fiord. Changing our course and blowing the *Diana's* whistle, we soon had the satisfaction of taking from the Peary dory Matt Henson, who delivered the following letter to Capt. Bartlett:

WINDWARD, April 28, 1899.

DEAR SAM:

Just a line to let you know where we are and that all hands are quite well. You will likely arrive at Etah before we get down. So I chance this by some Eskimos going down.

We were stopped here on the 18th of August, frozen in on the 23rd under Cape D'Urville, the south head of Allman Bay, about fifty miles north of Cape Sabine. The whole basin and channel were blocked all the season with heavy ice. As there is no probability of any one going down over the ice cap, I should not imagine there will be much need of your visiting Bowdoin Bay very early. Mr. Peary went north to Fort Conger on the 18th, and will not likely return before the middle of June, so I have no idea what his plans will be for next summer, but we will be in no condition for going north, as we shall be short of coal. Will have about ten days' steaming. I have no idea what time this ice will break up, but fear it won't until about from the first to the fifteenth of August. It seems to be a regular eddy in here, perfectly still, and we have had no wind or snow since leaving you last August, but very intense frost. I hope you will be able to keep well up to the down on this west side. Yours affectionately, JOHN BARTLETT.

P. S.—The Fram wintered just inside Cape Sabine.

Anchoring at Etah for the night, the Littleton Island post office and mail were brought on board the next morning, and Mr. Peary's letter "received and contents noted." (This letter was printed in BULLETIN No. 4, 1899, pp. 380–381.)

Saturday was occupied in landing the Robert Stein party and effects at Payer Harbor, near Cape Sabine. Soon after leaving Payer Harbor to return to Etah a ship was made out to the northwest, and in the hope, confirmed by Henson's assertion, that the *Windward* was coming out of her winter quarters we steamed for several hours through loose ice toward her, reaching the latitude approximately of 79° 10′. Finally, however, the stranger was definitely made out to be the *Fram*, whereupon the *Diana* returned to Etah, where she remained Sunday and, windbound, Monday.

Forty walrus, in accordance with Mr. Peary's instructions, were secured during the next four days, and returning to Etah, Saturday morning, Aug. 12, our disappointment at seeing the *Fram* in the outer harbor was soon changed to keen satisfaction at the discovery of the *Windward* safely anchored well within the protecting hills of the fiord. August 12 and 13 were devoted to visiting and preparations for the next chapters of the work, and on Tuesday the *Diana*, with Mr. Peary on board, left for a round of all the native settlements of Whale Sound, to gather equipment for next year's work, the *Windward* remaining for a walrus hunt in the waters off Etah and its vicinity. The *Diana* visited in succession the settlements at Cape York, North Star Bay, Saunders Island, Keati and Netilumi, killing nine walrus in Wolstenholme Sound and about 500 guillemots on Saunders Island.

We met the *Windward* according to programme on Monday, Aug. 21, at Northumberland Island, and learned that she had landed twenty walrus at Etah. Sixty tons of coal were transferred during the day from the *Diana* to the *Windward*, and at 7:30 P.M. the ships parted company exchanging salutes, the former homeward bound, and the latter to remain a week longer completing her work. Kangerdlooksuah and a deer hunt at Academy Bay, five fine animals being killed, occupied Aug. 22 and 23, Olriks Bay, Karnah, and the Robertson Bay villages, the 24th and 25th, and at 6 o'clock on the morning of Saturday the 26th a brief call by a boat party having been made at the site of Polaris House, Lifeboat Cove, the final return to Etah, for winding up matters, was made.

All day Saturday every man on board was diligently employed in discharging our cargo of provisions, nearly all of which, sufficient for the remaining years of Mr. Peary's work, were put on shore, and in taking on coal from his stock to offset the *Windward's* draft on ours. On Sunday the natives ballasted the *Diana*, the sloop *Senta* was beached and shored up for the winter, the last letters and instructions were written, and at 1, Monday morning, the *Diana* cast loose and proceeded out of the fiord, homeward bound, and amid hearty cheers, the firing of guns and the dipping of flags on ship and shore.

The native allies having been landed at Robertson Bay, Northumberland and Saunders Islands, departure from Cape York was taken at 4, Tuesday afternoon, for Disco. On Saturday, Sept. 2, by permission of the Danish governor, and with the assistance of Eskimos, twenty-five tons of coal was taken from the Kudliset deposits in the Waigat strait; on Saturday, Sept. 9, fifteen more were bought at Battle Harbor, Labrador, and at 3 o'clock on the morning of Tuesday, Sept. 12, the *Diana* dropped anchor at Sydney.

The cruise of the *Diana* was in all respects successful, and in some, remarkable. More than 5,000 miles of steaming were accomplished in fifty-two days, of which over 2,000 were north of Cape York, all without detention from ice or accident of any kind. Melville Bay was crossed Aug. 2 and 3 in twenty and a half hours, actual running time, the shortest passage on record.

Most important and gratifying, however, was the ample proof afforded by two weeks' constant association, of the excellent condition, physical and mental, of Mr. Peary and his associates; of the thorough good feeling between him and his native allies; of his deep appreciation of the support and confidence of the Club, and of his firmly established conviction of most important results to be achieved with the returning spring.

HERBERT L. BRIDGMAN,
Secretary Peary Arctic Club.

In concluding his lecture Mr. Bridgman presented in detail the existing condition and immediate future of the Peary Arctic Club's work. President McKinley, a few days since, signed the bill directing an American register to the *Windward*, now at St. Johns, N. F., completing repairs to her hull and engines. Under command of Capt. Samuel W. Bartlett she will sail from Sydney for the North early in July. The term of the voyage depends almost entirely upon Mr. Peary and his work. This done, the ship will return in the autumn; otherwise she will be detained. Abundant equipment—pemmican and ammunition, lumber, oil, coal, dog food, etc.—will be taken in accordance with Mr. Peary's requisition of last year, but of food for himself and his party he has ample supply, the *Diana* having left nearly forty tons at Etah, his winter quarters, in August.

Permission to land at the Greenland ports was granted to the *Windward* by the Danish Government only on condition that she carried no tourists. As to Peary's success in the attainment of the Pole, the most confident hope was expressed. His last words on parting at Etah in August were: "I believe I shall win." And against the recent public prediction of the commander of the Lady Franklin Bay Expedition that Peary will fail, was placed the letter, almost on the same day, of Capt. John Bartlett, who wintered with him on the *Windward:* "I expect that Peary is now at Cape Hecla, drying out his clothes and getting his teams ready for the start North." Peary's own plans for the spring, stated in his letter to President Jesup, Aug. 28, 1899, were as follows:

"After careful consideration I have decided to make no attempt to winter the coming season at Fort Conger, and when this reaches you I shall be settled at Etah for the winter. Two things control this decision; first, the uncertainty of carrying dogs through the winter, and second the comparative facility with which the distance from Etah to Fort Conger can be covered with light sledges. Of sixty odd dogs which I had when the *Windward* reached Cape D'Urville in August, 1898, only seventeen were alive March 1, and these too were useless for work; my experience in this is the rule and not the exception. No expedition has wintered in this region without having its dogs reduced during the dark months anywhere from 50 per cent. to practical extermination. With the usual perversity of such things it is almost always the best dogs that succumb while the poorest survive. Wintering at Fort Conger, I would have in the spring a few haphazard survivors of my full pack. Wintering at Etah, I shall have in the spring my pick of the best dogs of the Whale Sound tribe. With all necessary stores at Fort Conger for the northern trip; with ample caches of supplies from Cape D'Urville to Conger, and with my present knowledge of the region, I can go from Etah to Fort Conger with light sledges in ten to twelve days at the outside, and as the sun returns ten days earlier at Etah than at Fort Conger I shall really lose nothing in point of time. The distance between Cape D'Urville and Conger has been covered in nine days, six days and five days. I could have fixed a team of dogs and a driver, that I have no doubt would have covered the distance in three days. The Eskimos coming to the ship this spring usually came from Etah in three marches.

I shall take with me as far as Conger in the spring a large supporting party of natives, most of whom I shall send back at once with instruments, etc., while some will remain there during my absence north hunting and getting out the contents of the north lean-to.

My movements beyond Conger will depend upon existing conditions next spring. I may pursue my original plan of following the North Greenland coast to its terminus and then making straight for the Pole, or I may take the route I propose for this spring, namely direct from Cape Hecla."

Letters to Lieut. Peary were dispatched by the whalers from Dundee, Scotland, about May 1, for delivery at Cape York, from which point the natives will attempt to carry them to their destination—a route never before attempted, and which Peary will also try to utilize in the opposite direction.

TROPICAL HURRICANES.

BY

F. J. B. CORDEIRO, Surgeon, U. S. Navy.

The Caribs, who dwelt in the West India Islands long ago, before the coming of the white man, had a word in their tongue which has come down to us and passed into many languages. It is "Hurakan." In the China Seas they speak of a "Typhoon." The Samoans have their own word for it, and so on through every tropical country. These words all mean in the original a mighty wind, and refer to the same phenomena.

Now that we have possessions in the West Indies our attention has been called especially to that peculiar and complicated storm known as the tropical cyclone. For the first time American soil has been swept by its full fury, and our weather observers who have during the past year been distributed around the Caribbean Sea have had an opportunity of chronicling, if not the most severe, yet probably one of the most destructive storms that has ever visited these regions. During the past 300 years, 355 such hurricanes have been recorded; but these were only those of exceptional severity. It is as mathematically certain as the laws which govern them that they will continue to recur on an average of several every year, as long as the West Indies exist. It is interesting to conjecture here what would have been the result had Columbus encountered one of these storms on his first voyage of discovery. Had he passed through the "eye" of a severe hurricane it is extremely doubtful if his frail caravels could have weathered it, and the discovery of the new continent must have been delayed many years.

The hurricane of August 7, 8, 9, 1899, was like all others, differing only in degree. The author was on the southern coast of Santo Domingo at the time. Early on the morning of the 7th, long, heavy swells began coming in from the eastward, which was the method the storm used to telegraph its approach.

As these long ocean waves may travel with a velocity of 80 or even 100 miles an hour, while the storm itself seldom travels more than 20 miles an hour, it will be seen that its arrival may be anticipated a day or more in advance. In the afternoon of the 7th a telegram was received from Washington, saying that a hurricane somewhere to the eastward of Dominica was approaching that island in a westerly and somewhat northerly direction. If there had been any doubt as to the meaning of the long swells coming from the eastward all was now clear. The probable course of events could be forecast as follows—not from any special knowledge regarding cyclones (for our knowledge as to their laws has been hitherto singularly deficient), but because year after year they carry out the same programme, almost without variation. The wind would blow from the eastward of north, through north to southwest; the barometer would progressively fall, afterwards rising to about its original level. The track of the storm would be to the westward and northward. It would pass over Porto Rico by Turk's Island, sweep the Bahamas, and recurving somewhere about latitude 30°, would roll up the coast of the United States and out to sea, and then finally be dissipated. In the wake of the "Freight Train" the afterswirl would follow, and a persistent southeast wind could be expected. Martinique, Guadeloupe, St. Thomas, Montserrat, Porto Rico, Santo Domingo and the Bahamas, would be likely to suffer more or less damage according to the severity of the cyclone. And we know now that all this is what practically took place.

What the battering-ram effect of wind striking with a velocity of 80, 100, 125, or even 150 miles an hour is, and what the inundating effect is of the tremendous precipitation caused by cyclones, and of the tidal waves which the low centre may carry along, we have lately seen, and have seen many times in the past. The hurricane of October, 1780, called the Great Hurricane, was very similar to the recent one in many respects. While the loss of life in Porto Rico was appalling, it cannot be compared to the loss caused by the cyclone at Barisal and Backergunge, in India, in June, 1822, when more than 50,000 lives and a vast amount of property was destroyed. The West India hurricane of August, 1873, killed more than 500 people, damaged, stranded or wrecked more than 1,000 vessels, besides doing an enormous amount of damage to buildings on shore. Such is the terrible and extraordinary interest these phenomena possess for us.

It will be interesting to attempt to trace the course of a hurricane from its birth to its end. It must be premised that the sun, in its course round the earth day after day, heats a broad zone of the atmosphere directly under it. The air, becoming rarified by this excessive heat, rises directly upwards, very much like the hot air in a flue. This zone is known as the doldrums, and is about 10° wide. From the north and the south surface currents of cold air rush in to fill this void, which, owing to the revolutions of the earth from west to east, gives a northeasterly direction to the wind coming from the north and a southwesterly direction to the wind coming from the south. When the sun is to the south of the Equator, a corresponding state of affairs exists, the doldrums being bordered by the southeast trades on the south and by the northeast trades on the north, which become northwesterly after crossing the Equator. These so-called trade-winds, with the interlying zone of doldrums, follow the sun north and south of the Equator. A tropical cyclone always originates in the doldrums, and it may start over land or sea. If the surface of the earth were covered with water alone, it would be difficult to see how a hurricane could arise, since, the conditions being uniform everywhere, there would be no determining point from which it could take its origin. With land scattered about it is a different matter. Since the specific heat of water is much greater than that of land, the heat pouring down from the sun raises the underlying islands to a much greater temperature than the surrounding water during the day, and since during the night the land cools more rapidly, we have generally a "low" over an island during the day and a "high" during the night, which give rise to the sea-breeze of the day and the land-breeze of the night, so well known in the tropics. It is easy to see how a "low," arising over a sufficiently large island, could give rise to a very respectable cyclone.

Where, as in the recent cyclone, the "low" originated on the sea (to the eastward of Dominica), it is possible that a cause lay in the great ocean current coming up along the coast of South America, or a heavy precipitation of rain at this point freeing a vast amount of latent heat, and, by relieving the atmosphere of the pressure of a large amount of aqueous vapor, causing a diminution in the pressure that started the phenomenon. It seems hardly necessary to speculate further on how "lows" of unusual dimensions may be formed—on the contrary, it seems wonderful that they are not formed oftener.

However that may be, we will simply suppose that a barometrical depression of unusual proportions occurs suddenly at some point. The wind from all surrounding points immediately begins to rush towards the vortex. Since the air in the doldrums is usually calm, it must have the same revolutional velocity as the part of the earth over which it lies. Consequently, all the air coming from the southward will be deflected to the eastward of the centre, and all the air coming from the northward will be deflected to the westward, and a whirlwind will be formed which must revolve contra-clockwise. It will easily be seen that this is a general law for the northern hemisphere, viz., that every "low" in the northern hemisphere must result in a contra-clockwise vortex, while every "low" in the southern hemisphere must cause a clockwise vortex. Conversely, every "high" in the northern hemisphere must cause a clockwise whirl, while the opposite is true for the southern hemisphere.

We have, then, a phenomenon the counterpart of which is seen in the water flowing out of the drain-pipe of a bath-tub; or, more exactly, in the whirl of leaves on a gusty autumn day; or in a waterspout, which is a miniature cyclone.

Our cyclone is now formed. Before it starts off on its journey, let us survey it carefully.

The diameter of a cyclone may be anywhere from 100 to 1,000 miles, and its height from 20 to 40 miles. As the air is drawn in by a central attracting force, it follows approximately the so-called laws of Equal Areas, viz., a line connecting a given mass of air with the centre will describe equal areas in equal times. The general form of the whirl is as shown in Figs. 1, 2 and 3, Fig. 1 being a vertical view, and Figs. 2 and 3 being horizontal projections.

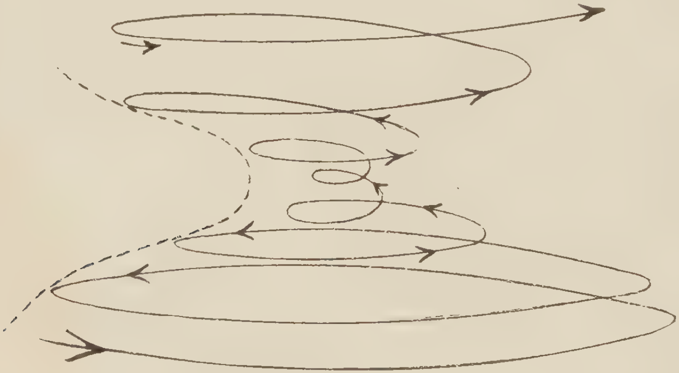


Fig. 1

It will be seen that a portion of air moving with comparative slowness at first, as it falls into the outer edge will gradually increase in velocity until it reaches the narrowest part of the "hour glass," which is some distance above the surface of the earth.

The highest surface velocities are not far from the axis and are usually 80 to 100 miles an hour—a force which few objects can withstand. It will be seen from Fig. 1 that "axis of the storm" is a more correct term than "storm centre." The barometrical pressure across such a cyclone can be well seen by examining the accompanying pressure gradient. It will be noticed that we have come to speak of our cyclone as an entity by itself, totally different from the surrounding air. Since its parts preserve their distances and relative relations it may, for all intents and purposes, be regarded as a solid body of equal mass rotating with its average velocity. This does not mean that the same air always constitutes the same cyclone, for such is not the case. The identical particles of air that caused so much change in Porto Rico are not transported to the Bahamas to continue their work there. On the contrary, this air, after having been "through the mill," is left high above the earth not far from where it was originally derived. It is like a rotary snow-plough, where, though the mass in rotation is constantly changing, still an average energy of rotation is preserved.

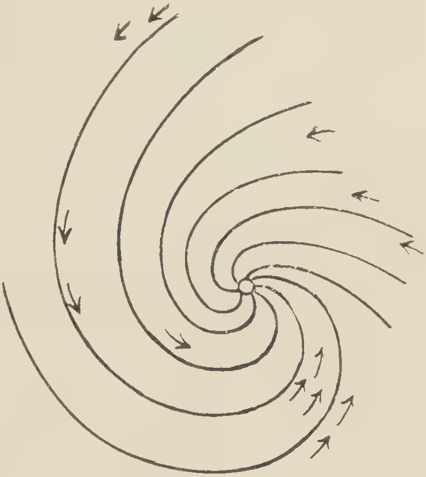


Fig. 2

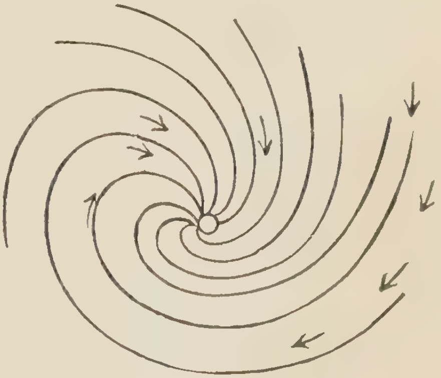
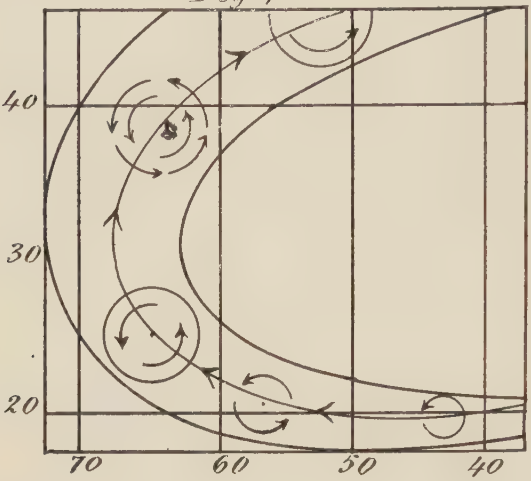


Fig. 3

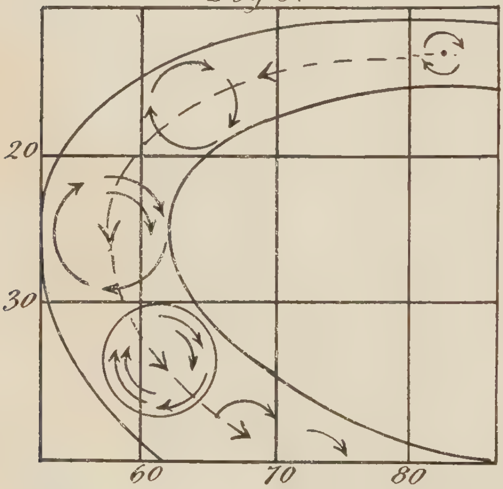
The most important question of all from every point of view, both practical and theoretical, now awaits us, viz.: Why does the cyclone move and what are the laws governing this motion? Up to this time this part of the problem has been considered inexplicable. It will be seen that if the laws governing revolving storms (and all storms are revolving) were understood, and this knowledge could be applied to predicting their paths, meteorology would advance with one bound from scientific guesswork to an exact science. If the path of a cyclone can be predicted from its "elements" with the same accuracy as the path of a comet, then the science of meteorology acquires a dignity commensurate with that of astronomy. I believe this point has been reached. Given a cyclone with a known "moment of inertia," of a known mass, rotating with a mean angular velocity at a given latitude and longitude, and its path and subsequent motion may be determined. The importance of this knowledge to all regions lying in the track of the cyclone is evident.

Fig 4

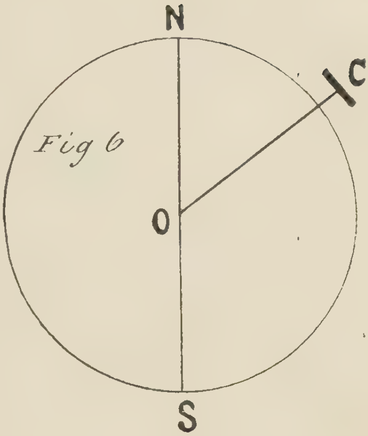


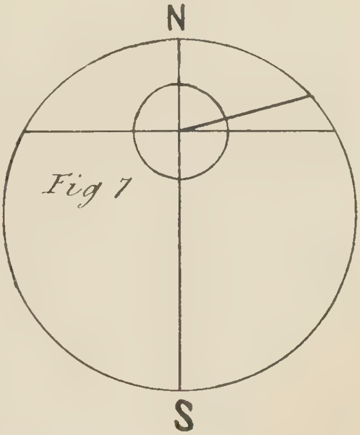
Let Fig. 6 represent a section of the earth through its axis and C a cyclone at the extremity of the radius OC rotating in the northern hemisphere contra-clockwise. Since the radius OC rotates with the angular velocity of the earth, our cyclone may be regarded as an ordinary gyroscope. As the average velocity of the air of which the cyclone is formed is that of the surface of the earth under its axis, we may consider merely the motion of a gyroscope OC moving about a fixed point O or an imponderable axis OC.

Fig 5.



It is not the intention of the author to give the complete analysis of the motions of a gyroscope under the given conditions, since this





is professedly a popular article. The object is simply to elucidate the subject to the non-mathematical mind.

To the reader with a slight knowledge of mathematics, it will be sufficient to say that the gyroscope is an instrument that develops a deflective force normal to the plane in which it is turned. For instance, if our cyclone is turned with the earth, it will develop a deflective force, tending to increase its latitude, and a certain velocity will be developed towards the pole.

This velocity likewise will develope deflective force, tending to increase its longitude.

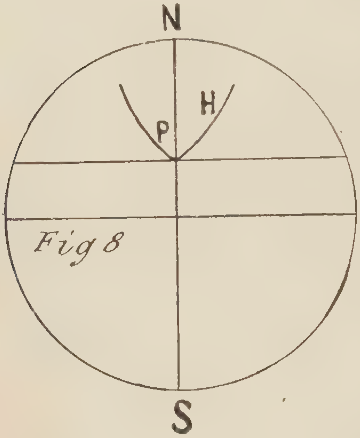
Let *x* represent the longitude and *y* the latitude of the axis, and suppose an initial impulsive velocity equal to the velocity of the earth at the point be given to the cyclone. Considering only a portion of the spherical surface small enough to be regarded as plane, we have as the equations of motion:

$$\left(\frac{d^2y}{dt^2}=k\frac{dx}{dt} \ \& \ -\frac{d^2x}{dt^2}=K\frac{dy}{dt}\right)$$

since the normal deflecting force is proportional to the angular velocity. Integrating these equations we get as the curve of motion $x^2+y^2-2\frac{Vo}{k}y=o$, which is the equation of a hyperbola situated vertically, with the origin at the upper vertex. It may be remarked that k above is equal to $\frac{CW}{RM}$ where R is a radius of the earth, and C, W and M are respectively the Moment of Inertia about the axis, the angular velocity and the mass of the cyclone.

It will be seen, therefore, that if the earth were at rest, and the cyclone given an initial velocity equal to its actual rotational velocity and started from a point P, it would describe the curve PH, which is for a small surface a hyperbola, as drawn in the figure with P the initial point at the vertex. Since no work is done the living forces must remain constant. Therefore

$$\left(\frac{dx}{dt}\right)^2 \text{Sin}^2\vartheta + \left(\frac{d\vartheta}{dt}\right)^2 = \text{Const.}$$



In other words, the gyroscope or cyclone will travel in the curve with a constant velocity equal to that originally impressed upon it. To obtain the actual path of the cyclone, we must compound the above motion with the motion of the earth about the axis. It is readily seen that the cyclone, starting out with the same velocity as the point of the earth on which it rests, gradually lags behind and goes to the northward. As it moves in the right-hand branch of the hyperbola PH it finally reaches a point where its velocity is equal to that of the earth. Here it stops going to the westward; shortly beyond its velocity becomes greater than that of the earth, owing to the diminishing circles of latitude. Here it moves to the eastward, but during the whole of its motion continually makes northing. The arm of the hyperbola being regarded as a straight line, which it may nearly be, it will be seen that the velocity to the northward is tolerably constant, while the velocity to the westward is constantly retarded and that to the eastward constantly accelerated; so the curve of the cyclone on the earth's surface must closely resemble a parabola, with the axis east and west. It is well known that a body moving with a constant velocity in one direction and with a constantly accelerated or retarded velocity in a direction at right angles must describe a parabola—a projectile, for instance. And such, in fact, do we find to be the actual paths taken by cyclones. The above is a rigidly exact explanation of the path of a cyclone, which has been a sore puzzle ever since it was first observed. Compare the paths delineated in Chart I and II from Piddington's Sailor's Hornbook. It will be seen that these paraboloid curves all have individual differences, depending upon differences in C, W and M, and the latitude and longitude where they started. That the path can easily be calculated from the "elements" is now clear. The meridian where it will recurve, its velocity at any point, and in fact anything about its subsequent motion can be predetermined. As to its velocity, it will be seen that if the generating hyperbola is very broad, so that the branches tend to coincide with the parallel of latitude on which it rests, the velocity may be very slow, but it never can be stationary. Some authors have spoken of stationary cyclones. Mathematical analysis shows that such a thing is impossible. When the branches are very narrow there may be a high velocity. As a matter of fact the observed velocities have ranged from 3 to 50 miles an hour or even more.

It remains to explain the observed broadening out of cyclones as they progress. This is on the same principle as a snowball increases in size by rolling. They are rolling stones that gather moss. The tendency of this is to destroy the original motion of rotation and lead to their dissipation. This is further helped along by friction on the surrounding air and on the surface of the earth. The continual precipitation of rain leads to the escape of a constant supply of latent heat, which acts in the axis like a flue and has a continual "winding-up effect." How far these antagonistic forces balance each other it is impossible to say. They frequently have energy enough to keep under way for two weeks or more, though many die out in a week and the feeble ones in a few days.

Much condensation is a concomitant of most cyclones, as might be expected when saturated vapors are exposed to various temperatures and pressures. In a waterspout the hot saturated air of the central shaft is surrounded by the cold spiral of the external air, and condensation results; but the water here is wholly fresh. There is no sucking up of the sea water, appearances notwithstanding.

These tropical cyclones, as has been said before, are not limited to the West Indies, but are found in the doldrums everywhere especially where there is a mixture of land and water. The author has been in four of these storms—three in the West Indies and one at Apia, Samoa. Two of these were axial. The subjective and objective symptoms are the same in all. The last sunset before the storm has a peculiar look, which can best be described as "oily." There is no mistaking such a sunset when once seen before. These storms last three days, as a rule, at the same point. The circumference is cloud-capped, but the axis is usually clear. An absolute calm exists in the axis, which lasts only for a short time (one hour or more). Here are found mountainous, confused seas, which are very dangerous—more dangerous, in fact, than the winds.

When coming upon indications of an approaching cyclone at sea, the navigator can usually, from the direction of the wind, determine his position relatively to the path of the storm, and lay his course so as to escape as much of it as possible. Since the axis travels at little more than steamship speed on an average, he will usually be successful.

On land these storms cannot be avoided, and should be met by prudent anticipation. Areas of land that have been inundated and are liable to be inundated again should not be built upon. But human nature is much the same, whether in the United States or Porto Rico. When a hurricane revisits any place it usually finds the same work to do over again.

In recapitulating it will be seen that when the "elements" of a storm have suitable values, it may never recurve, though this is almost always the case. A cyclone has never been known to cross the Equator; the above analysis shows that such a result is impossible. The above laws apply to any storm at any point of the earth's surface. The only difference between a tropical cyclone and other atmospheric disturbances lies simply in the superior energy of the former; and the energy of all is seen to be derived directly from the sun.

In summing up, we see that a "low" is formed by the sun at some point determined by local conditions. Owing to the rotation of the earth on its axis, a whirlwind must result contra-clockwise in the northern hemisphere and clockwise in the southern hemisphere. The energy of the whirlwind will be proportional to the difference of temperature of its parts, as is the case in all heat engines—and a cyclone may be regarded as a heat engine. A cyclone having its own proper rotational velocity, combined with a rotation about the axis of the earth, is a gyroscope simply, and obeys all gyroscopic laws.

It has long been a source of wonderment that the cyclone should move, just as for years it was considered a paradox that when acted upon by gravity the gyroscope should sustain itself and not fall to the ground. Some idea of the force impelling it may be formed by considering the cyclone as a solid wheel revolving about its axis. If all the axles in the world were welded together into one, it would be unable to hold the cyclone to a fixed point.

The independent motion of a gyroscope, acting under the two rotational forces described above, is in a hyperboloid curve, *i. e.*, it is as close an approach to an hyperbola as it is possible to describe on a spherical surface. We may call this curve a "Spherical Hyperboloid."

This independent motion of its own, combined with the revolution of the earth on its axis, gives us the path of the cyclone as traced on the surface of the earth. This path resembles a parabola with its vertex pointing to the west. According to the conditions of the problem, the axis of the spherical paraboloid may deviate somewhat to the northward (or southward) of a strictly east and west line. The detailed analysis of the problem, together with the computation formulæ, would be out of place in any other than a mathematical journal.

THE TERRITORY OF ANADYR.

(From the Russian of E. Olssufjev, by E. Bondy.)

The territory of Anadyr occupies an area of irregular form of about 567,000 square miles, having a peninsula in the east, the so-called Chukchi Peninsula. The country is divided into three parts—the northern, which is almost uninhabited, and has been but little explored; the eastern, consisting of Chukotski Noss, and the southern, which occupies the valley of the Anadyr River. The last forms a broad, partly hilly territory, and is surrounded by mountains, which approach each other more and more as the river nears its mouth, and almost enclose it at that point. From about the middle course of the Anadyr the tundras are covered with low bushes, dwarf larches, cedars and willows, and towards the east even this sparse vegetation ceases.

The aspect of the country about the Novo Marinsk Post is especially dreary, for there is nothing to be seen but a vast expanse of greyish-yellow hills, covered with moss, though along the upper course of the Bielaja and its branches some poplars are found, and there is a surplus of good timber along the upper course of the rivers. This can always be counted upon to supply the demand along the lower course of the Anadyr.

The Anadyr rises in the Stanovoi Mountains, and as far as Jaripol it has the appearance of a large mountain stream. Here it is joined by the Pelidon, and attains a width of 170 metres, and the current becomes so strong that it is exceedingly difficult for a boat to make its way to Jaripol from Markovo.

The depth of water in the lower course of the river varies between two and four and a half metres, but near the mouth it does not exceed one metre.

Below the confluence with the Krasnaya there are formed on both banks peninsulas of sand, which make natural harbors for the boats, though even here, owing to the strong winds, navigation is not without danger.

The river water is not drinkable opposite the Novo Marinsk Post, as it is already mixed with the sea water, but near Point Kedrov it becomes drinkable at low tide. Near the so-called American Neck of Land the water still has at times a bitter taste, but above this point the influence of the sea water is not noticeable. Sweet water, however, is obtained from the tundras and from the thick layers of snow which lie piled up as high as ten or twelve feet along the banks; these are drifts made by the winter storms and they never disappear before the end of August.

The ice of the Anadyr generally begins to move between the 1st and the 13th of June, but for a month before that time ice-holes begin to make their appearance.

Little is known of the Krasnaya and Bielaya Rivers, which empty into the Anadyr, as they have never been explored; but judging by the reports of the Chukchis, they must be streams of considerable size.

Neither do we possess much information about the Chukchi Peninsula, except that it is perfectly barren, and that the northern coast is indented and cut by many gulfs and bays.

The climate of the Anadyr territory is less severe than its latitude might lead us to expect. The western part, indeed, is influenced by the climate of the continent, but the softening effect of the Pacific Ocean is felt in the east. In Markovo spring begins on the 1st of June; while near Novo Marinsk the river at this time is still covered with ice, and a change does not take place before the end of the month.

THE POPULATION.—The Russians live in the village of Markovo and in small settlements near by. Markovo is situated on the left bank of the Anadyr, *i. e.*, on its middle course, and consists of 41 houses and 340 inhabitants. This is the winter residence, but in summer the people remove to other places, about twenty-five miles away. The whole population speaks Russian, and knows no other tongue.

They all belong to the parish of Markovo, and they are divided into three classes—the rich; the middle class, mostly employees of the rich; and the very poor. Most of them live in huts, but the poor in tents, after the fashion of the Yakuts. The richest only have glass windows in their houses, others use blocks of ice in place of glass.

The rich have wooden floors in their homes, and are provided with chairs, a table and a bed. The poor have just a few benches along the wall. In one corner there is a shrine; in another the fireplace. Several of the poorest families live together in one hut, the roof of which extends about one yard above the surface of the earth, as the interior is dug into the ground. The small windows hardly admit any light. Reindeer skins are spread on the ground, but there is no furniture at all. The tenants of this abode hardly find room to sleep.

There are no fences around the houses, but only a shed for keeping fruit some few feet away.

There is but one tent in Markovo; but in the smaller settlements there are more of these, as the people are poorer on the whole. In summer the people sit in the dark to protect themselves against the gnats, which are attracted by the lights.

The dress of the people is very much like that of the Chukchis, which has been adopted by all the Russians of Northern Siberia.

There are different types among them. Some show strong signs of Russian blood; others, descendants of the Tchuvassis, have long flat faces, protruding cheek bones, small black eyes without eyebrows, and thick lips; far from good-looking and strongly recalling the Mongolian type. A third type, descendants of the Yukagirs, have quite expressive eyes and more finely developed features; they are well built and the women are fair. The entire population lives principally on fish and reindeer meat, with a little game. They are used to eating a great deal, and cook from three to five times in the twenty-four hours. Brick tea is a necessity for them; but only the rich can afford to have bread and salt, and provisions are kept more by cold than by salting. Brandy was unknown among these people until quite recently, as it was a prohibited article; but since it now can be obtained by procuring a license, unlimited qualities are consumed. This habit exercises a very demoralizing influence on the people, for as soon as the inhabitant of the north has felt the effect of liquor he knows no moderation in using it, and will ride any distance to obtain it.

About May the ice begins to move and the river water to rise. Gradually the banks are overflowed, and in a short time Markovo and its surroundings are inundated. The people do not mind this, as they are fully prepared to move, and soon go to their summer homes in rowboats. They choose a spot which is convenient for fishing, this being their principal means of gaining a livelihood, and they also devote themselves to the breeding of reindeer during the summer months.

July is the time for red fish or sturgeon, and at this time the hardest work is accomplished. If the fish are plentiful the wealth of the people is assured for the year; if scarce, they move on and seek a better spot. The condition of the rich as well as the poor is terrible if no fish are caught at all, as is sometimes the case.

Kennan describes the terrible condition of the Markovzys in the year 1867 in his "Life in Siberia."

The reindeer hunt begins in August; by September the principal work is over and the people return to Markovo.

A brisk trade takes place in December in the nomadic camps of the Chukchis, for then the merchants return from the Gischiga fair, and a lively exchange of wares, furs, and domestic articles takes place, as money is not in use with them.

Concerning the character of these people, only good can be said of them. Their active life, which calls for long journeys coupled with great privations, has developed in them great ingenuity and a spirit of enterprise. There is a strong feeling both of friendship and kinship among them, and also a love of work.

The family ties are very strong and the father is the ruling lord of the home. Marriages are made exclusively by the will of the parents. Illegal children are born, though this is not considered sinful; yet the women are generally faithful. The people are ideally honest, theft is unknown and fighting is tabooed; neither do they know of social games, plays or dances.

Reading and writing are not yet general among them; but they are all religious, and the clergy are highly respected. Regarding the state of health of the inhabitants of Anadyr, the women have been found subject to nervous diseases and the men suffer a good deal with rheumatism. Cases of scurvy seldom appear. Since a few years a doctor makes annual visits to Markovo, each lasting several days; and every five or six years a surgeon appears on a vaccinating tour. The people themselves devote their time to the study of medicine, or rather the art of healing, which has been handed down to them from the Yakuts and the old Russian population.

GEOGRAPHICAL RECORD.

COLONIES OF THE UNITED STATES.

The Telegraph in the Philippines.—The United States Signal Corps has in the past two years erected or laid 2,500 miles of telegraph and cable lines in the Philippines. About 7,000 messages are sent over these lines every day. The plans, as far as outlined, contemplate the connection of Manila by wire with the most important points on all the larger islands between the north end of Luzon and the north coast of Mindanao, a north and south distance of about 750 miles. Two lines of wires now extend from Manila to the north coast of Luzon, one skirting the west shore and the other passing northward through the ricefields of Central Luzon and the rich tobacco district of the Rio Grande de Cagayan to the tobacco port of Aparri. Twenty short lines have been built between the central trunk line in Luzon and important towns east and west of it. Sections of the trunk lines are now in operation in most of the larger islands. Thus, while the development of the system in Luzon is far towards completion, over 150 miles of land wires are now in service in Panay, about 100 miles in Negros and 50 miles in Cebú. With the aid of the British cable to Cebú only about 160 miles of land wires and cable are now required to place Manila in touch with north Mindanao. The first cable in the system to connect all the islands has been laid between Cebú and Leyte. The first purpose of these lines was, of course, to serve American military needs, and they are commercially used very little as yet, but such use is hoped for in a few months.

Mapping Philippine Waters.—Secretary of the Navy Long sent a communication to the Senate in May on the necessity of an immediate survey of Philippine waters, as the existing charts fail to indicate many dangerous reefs, and are otherwise deficient. The present Philippine charts, all of British, Dutch and Spanish origin, are adequate only in respect of the approaches to a few of the larger ports, like Manila, Iloilo and Cebú, which are engaged in direct international trade. But there are many minor ports which will be the only outlets for the products of their districts until railroad building is largely developed. The hemp, tobacco, rice and other products of these districts are collected by small steamers that ply solely in the island trade. Not a few of these little ports, at the head of narrow and rock-strewn channels, are not easy of approach, and the service of local pilots is imperative, for there are no charts. Owing to the exhaustion of the supply of Manila hemp in this country our gun-boats were ordered, early this year, to open the hemp ports, where thousands of bales of this fibre were stored. In February seven of these ports were again made available for commerce. In carrying out this work our vessels picked their way carefully along the channels, one of which, however, was not entered, as no pilot could be found. Not only good charts of the harbors and coast-lines are needed but also exploration of the coast waters for the discovery of menaces to navigation, such as the reef that wrecked the cruiser *Charleston* last year.

HYDROGRAPHIC WORK OF THE COAST AND GEODETIC SURVEY.—Nine vessels of the United States Coast and Geodetic Survey are now engaged in hydrographic operations. The sphere of service of the Survey has been extended by the acquisition of the colonial possessions. Three vessels have been employed on the coast of Porto Rico, where the surveys are nearly completed. It is expected to continue the surveys along the Hawaiian coasts until all portions that are of commercial importance are completely charted.

SOUTH AMERICA.

EXPLORATION OF THE UPPER XINGÚ.—Dr. Hermann Meyer, in 1896 and 1897, made a very fruitful journey in the upper basin of the large Xingú tributary of the Amazon. He returned to this region in 1898 and 1899 to map the sources of the river. According to his report on the result of his latest work (*Verhandlungen* of the Geographical Society of Berlin, 1900, Nos. 2 and 3), the Xingú is formed by the union of five rivers, whose course is nearly parallel—the Kuluene, the Kulisehu, the Auiya, the Batony, and the Ronuro—which in their turn receive numerous tributaries, running much in the same direction as the principal arteries. These watercourses descend from the northern slope of the plateau which separates the basin of the La Plata from that of the Amazon. Although the areas drained are narrow, they receive such a quantity of water that they soon become deep rivers, more than 300 metres wide; and Dr. Meyer is of the opinion that clay deposits under the superficial gravel-beds prevent the water from sinking deeply. The Formoso branch of the Ronuro may be regarded as the head stream of the Xingú. Dr. Meyer descended the great rivers to the Amazon, meeting difficulties at nearly every step. Trees and other obstructions impeded his canoes on the upper river, and the series of falls and rapids farther down exposed his expedition to many dangers. On the Ronuro Dr. Meyer met Indians who did not know the use of iron. The data he collected will greatly improve the mapping of the Xingú basin.

EUROPE.

GOLD IN LAPLAND.—*Le Tour du Monde* (May 19, 1900) says that the Norwegians have begun prospecting for gold in the Altenelv valley, about sixty miles south of Bossekop, in the heart of Lapland. The results thus far have been very satisfactory, and placer operations will be continued during the summer. The geological formation is similar to that of the Klondike region, and it is thought probable that it may contain large auriferous wealth.

RUSSIA'S ARCTIC HARBOR.—*La Géographie* (April, 1900) describes the development of Alexandrovsk, the town which was built by order of the Russian Government about two years ago on the Murman coast. Though situated north of the Arctic Circle, Catherine Harbor, on whose shore the town stands, is ice free, and the water is deep enough for the largest vessels. A wharf has been built out into the harbor about 500 feet. An aqueduct from a lake brings excellent drinking water to the town. Alexandrovsk now contains a population of about 250, mostly officials and laborers, 50 houses, a hotel and a few stores, and is lighted by electricity. Some colonists have settled in the place, and it is expected that most of the inhabitants of Kola, further south, will remove to Alexandrovsk, which has a better location and a milder climate. It is not expected that the town will have large growth until it is connected with St. Petersburg by rail. This road is certain to be built, and it is expected that the port will be the outlet for considerable merchandise from the interior of Russia, as it will have advantages over Baltic seaports, which are frozen over every winter.

ASIA.

THE NEW PORT OF SAN-TU-AO.—It is expected that the port of San-tu-ao, which the Chinese Government opened to commerce last year, will do a considerable business in the export of tea. The river valleys in that district are noted for the excellence of their tea crop. Heretofore coolies have carried on their backs the large tea exports from this region to Fuchau, four days' journey to the southwest. As yet, however, the port shows no indication of rivalling Fuchau in tea exports, as very little commerce has passed through the new port in the past year. Some trouble, it is feared, may be caused by the coolie porters, who will lose their usual means of livelihood when vessels begin to load with tea at the new port.

VOLCANOES IN EAST SIBERIA.—The *Deutsche Rundschau für Geographie und Statistik* (May, 1900) reports the discovery of two volcanoes west of the Yablonoi mountain range, on the Vitim plateau. The volcanoes have been named in honor of the Russian explorers Muschketov and Obrutschev. The mountains are apparently situated over 100 miles to the north of the junction between the Trans-Siberian and the Manchurian Railroads and 150 miles east of the north end of Lake Baikal. No volcanoes have hitherto been reported in any part of Siberia, except in Kamtchatka, where there are a large number that are frequently in eruption.

AFRICA.

THE MOORE EXPEDITION TO TANGANYIKA.—The expedition in charge of Mr. J. E. S. Moore, which was sent from England last year to Lake Tanganyika, has completed its work and is now on the way home. It has proved that the ancient marine fauna discovered in Lake Tanganyika, which indicates the former connection of that lake with the sea, does not extend to any of the lakes situated further north. It has also ascertained that the lake formerly covered a large extent of country, both to the north and south of its present situation; also, that the longitudes previously computed for the lake are erroneous, and that most of it lies about 30 miles west of the position hitherto shown on the maps. The earlier mapping of the coast-lines is comparatively accurate, so that the shape of the lake on the new map will not differ much from the older delineation. But the lake will now be shown as having a more northeast and southwest direction. The map made by missionary Hore has for fifteen years been used in every atlas of Africa, but it has at last met the fate that usually overtakes the early surveys of every region. These pioneer maps answer their purpose very well until finally supplanted by more accurate mapping, the natural result of better instruments and more scientific methods.

GOLD IN KATANGA.—The Katanga Company of Belgium was organized to exploit that large district among the southern headstreams of the Congo known as the Katanga district. It has long been reported that this region was very rich in minerals, and the company expected to give most of its energy to mining. The report of its exploring expedition, led by Mr. Lemaire, is disappointing. He crossed the whole region from the Luapula in the east to Lake Dilolo in the west, and then turning east again followed, for the most part, the water-parting between the Congo and the Zambesi. The geographical results of the expedition are of much importance; but Mr. Lemaire has discovered neither gold nor silver.

> "All that has been said about the mineral wealth of Katanga," he writes, "is the pure product of the subjectivism which is characteristic of the accounts of many travellers."

All he found was a little copper and plenty of iron.

Dr. Ansorge's Trip across Africa.—Dr. W. J. Ansorge has just crossed Africa from the Indian Ocean to the mouth of the Congo. He made the journey from Fort George, on Lake Albert Edward, in Central Africa, to the Atlantic in 79 days, which is remarkably fast time considering that he passed entirely through the great forest belt, where travelling is slow and difficult. In the forest through which his course led to the northwest he met one of the pigmy tribes. When he reached the Ituri River, which is called the Aruwimi in its southern part, he descended it to the Congo, and steam accelerated his journey all the way from the upper river to the ocean. He made a fine collection of birds and butterflies, but it was naturally impossible for him to extend his collections in many other directions during so rapid a journey.

COMMERCIAL GEOGRAPHY.

Emden as an International Seaport.—The *Deutsche Rundschau für Geographie und Statistik* (May, 1900) says that the small city of Emden, which heretofore has had little importance except as a North Sea fishing port and the outlet for garden produce forwarded on small vessels to England, is about to become an important international port. The Government spent much money for its development in 1899, and the work is still in progress. Steamship communications with Danzig, Stettin, Königsberg, London and St. Petersburg are being established. Ample accommodations will be provided for large vessels. The Shantung Railroad Company, which is building a railroad in the Shantung province of China, about 300 miles in length, has stopped its shipments of steel and iron from Hamburg and Bremen and will transfer this business to Emden.

Electricity on the Nile.—*La Nature* says that the Egyptian Government, last fall, instructed Professor Forbes to study the question of the industrial utilization of the cataracts. He spent the winter in upper Egypt and the Sudan. In his report he says that the first cataract at Assuan may be electrically employed to furnish power for the pumps used in the irrigation of lower Egypt, and to run the sugar and other machinery in upper Egypt. He believes also that the second cataract near Wady-Halfa may supply the necessary power to run the Sudan Railroad as far as Abu-Hamed; and that the trains from Abu-Hamed to Khartum may also be electrically run by means of generators installed at the fifth and sixth cataracts. Some other engineers are not so sanguine as Prof. Forbes seems to be of the possibility of utilizing the water-power of the cataracts to so large an extent.

GROWTH OF CONGO COMMERCE.—The expansion of business in the Congo Free State is almost unequalled in Africa. Exportations have doubled and importations nearly so since the opening of the railroad around the rapids only two years ago. The exportations last year amounted to $7,213,591. The exports in 1886 were only $177,286, and in 1896 they were $2,477,919—in other words, they have nearly trebled in value in four years; while the importations, which last year were $4,465,169, were more than twice as much as in 1893. The rapid growth of the rubber industry accounts chiefly for the increased commerce. The value of rubber exported last year was $5,794,701, the next most important item being ivory, $1,511,092; while palm nuts yielded $310,704, and palm oil was exported to the amount of $146,902. These were the only very important articles of export.

DIAMONDS IN BRAZIL.—The diamond industry in Brazil is now carried on only by individuals or small companies working in a crude manner. The yield was never much over $1,000,000 a year, and the product is worth now annually less than $200,000. Still the quality of Brazil stones averages higher than that of the Kimberley output. Brazil gems rarely leave the country until they are ready for the jewellers, for they are cut either at Diamantina, Gouvea or Rio de Janeiro; while the Kimberley stones are sent in the rough to the London market in March every year, and are then distributed to the diamond cutters of Holland and Belgium. In 150 years of mining operations Brazil has yielded about $100,000,000 worth of gems, or a total output that is equalled every six or seven years by the product of the Kimberley mines. The total sales of African diamonds already exceed by millions the value of all the gems Brazil has produced, though African diamond mining has been carried on only about thirty years.

THE POLAR REGIONS.

SOME RESULTS OF THE BELGICA EXPEDITION.—M. E. Racovitza summarizes in *La Géographie*, No. 2, the work done in the Antarctic by the *Belgica*.

Palmer Land was found to be a vast archipelago of little islands. Hughes Gulf is the entrance of a strait which connects Bransfield Strait with the Pacific. This strait extends in a northeast-southwest direction from 63.51° to 65°, South Lat. The Pacific end, which is called Belgica Strait, is probably Dallmann's Bismarck Strait, erroneously placed by him too far to the south. Trinity Island is only the cape of a body of land to which has been given the name of Danco Land. This forms the eastern shore of Belgica Strait, and is nothing more than a continuation of Graham Land.

The sides of Belgica Strait are high and mountainous, with steep slopes and narrow valleys, and one peak appeared to be more than 2,000 metres in height.

The channels, which have great depths in the middle, lead through almost vertical banks, and the whole aspect is that of a sunken region in which the valleys have been invaded by the sea.

These lands are entirely formed by ancient crystalline rocks, granites, green stones and syenites. Gneiss was seen only at the mouth of the Pacific Strait.

In January and February some of the small islands were only partially covered with ice, while all those of a larger extent and Danco Land were completely covered with an immense crust of ice, which showed itself under three different forms. The interior was all occupied by a frozen sheet, which may be compared with the Greenland inland ice. Everywhere upon the mountain sides were suspended glaciers, and in all the valleys tremendous crystalline currents, which ran into the sea; alone the perpendicular cliffs showed a naked rock. The limit of eternal snow coincided here almost to a certainty with the level of the sea.

Another important geographical discovery is that of a continental tableland or plateau, situated between longitude 75° and 103° west of Greenwich, and from latitude 70° to 71° 35′ South. The mean depth in which it is is 500 metres, with an abrupt fall to 1,500 metres towards the north.

The depth of the continental plateau, generally placed at from 200 to 300 metres, shows that this region underwent also the depressive movement which was remarked in the lands of Belgica Strait.

The plateau rises gently towards the south and sinks in its eastern portion towards the north to connect itself most assuredly with the continental plateau of Graham and Alexander lands. It must connect in a similar manner towards the west, 50° further, with the continental plateau discovered by Ross, east of Victoria Land. We should then have a continuous continental mass from longitude 50° west to longitude 60° east, and the discovery made by the *Belgica* gives support to the hypothesis of an Antarctic continent. The sediments contain, beside the gray slime, a very strong proportion of sand, gravel, and a very great number of pebbles of rounded form, which were certainly rolled by the sea. The transport of these materials must have been made by the ice. If this plateau indicates the existence of a continental mass south of the 72° parallel, inversely the driftway of the *Belgica* demonstrates the non-existence of the ice-wall signalled by Bellingshausen; and the same thing may be said of the land signalled by Walker, since we passed with the ice-drift over its supposed spot. The easy drifting of the pack towards the west renders impossible the presence of the land signalled by Cook towards longitude 105° west.

THE DANISH METEOROLOGICAL INSTITUTE has published information on the state of the ice in the waters east and west of Greenland in 1899. This information has been compiled by Capt. V. Garde, from observations by the captains of sealing and whaling vessels, from Danish functionaries in Greenland,from Admiral Makarof of the Russian Navy, from the meteorologists of the Swedish expeditions in the Arctic, and from the members of the Danish expeditions to the east coast of Greenland.

Six maps, one for each month from March to August, illustrate the report.

Capt. Garde's study of the observations brings him to the following conclusions:

(1) In the Kara-Sea, in the western part of Barents Sea, S. E., and partly N. of Spitsbergen and in Smith Sound, there has been more than the normal quantity of ice.

(2) South of Franz Josef-Land and on the east coast of Greenland there has been considerably less ice than usual.

In Davis Strait the conditions were nearly normal, and in Baffin Bay and Melville Bay the state of the ice was more favorable than in 1898.

The extraordinary scarcity of icebergs in the southern part of Davis Strait in the summer of 1899 is explained by the very great number of bergs (about 2,000) which were met with at Cape Farewell in October. These were undoubtedly the same that were observed by Lieut. Amdrup in July, a little to the north of Angmagsalik.

It is thought that the spring season this year will be a favorable one on the south-west coast of Greenland.

The following telegram to the Brooklyn *Standard Union* was published by that paper on the 9th of June:

St. Johns, N. F., June 9.

The Peary Arctic steamer *Windward* came out of the dry dock to-day, having fully completed the extensive repairs which have been in progress for several months, and will shortly leave for Sydney, C. B., in command of Capt. Samuel W. Bartlett, to take on coal and supplies for her voyage to the North. While the new engines desired have not been obtained, in consequence of the utter inability of manufacturers both in Great Britain and in America to take up the contract, a new shaft and propeller have been supplied, the old engines thoroughly overhauled and put in the best possible order, so that at least a knot and a half an hour in speed has been gained, bringing the *Windward* up to the *Kite* of the 1891–1892 and 1895 expeditions. In addition, the hull has been thoroughly rebuilt, strengthened, both within and without, and the *Windward*, as a whole, is in far better condition than she has been for years, new boilers having been installed by Mr. Harmsworth shortly before he turned her over to Mr. Peary in 1898.

The *Windward* will this year sail as an American ship, so far as her nationality is concerned, the necessary legislation by Congress having been approved by President McKinley, though, not having entered an American port, the formal register has not yet been issued. Capt. Bartlett has, however, a copy of the act, certified by the Secretary of the Treasury, upon which the United States consuls and foreign authorities of any port will permit the *Windward* to fly the Stars and Stripes. The rebuilt *Windward* will be, therefore, the first Arctic expedition steamer to carry the Stars and Stripes at the peak since the ill-fated *Polaris* left the Brooklyn Navy Yard in July, 1871, under command of Capt. Charles F. Hall, who died on board a few months later.

The expedition will sail from Sydney about July 1, and proceed directly, with a call at Disco, to Etah, North Greenland, Mr. Peary's winter quarters, where instructions from him will doubtless be found, or, if not, will be awaited. The *Windward* will take with her the maximum quantity of coal which she can carry; additional lumber, oil, sugar, arms, ammunition, provisions, scientific instruments, and everything which is necessary for Mr. Peary's work. The *Windward* also takes two new whaleboats, built at New Bedford, for the Peary service, thoroughly equipped in every detail.

It is, however, quite possible that Mr. Peary may have attained the Pole this spring, in which case he will, of course, return with the ship; if not, the additional equipment, with what remains of the forty tons of supplies left at Etah by the *Diana* last year, will be ample for the remainder of the time which he will devote to his work. Upon the arrival of the *Windward* at Etah, Mr. Peary will assume command, and her further movements will be subject to the conditions of his work and to his instructions. No passengers will be taken on the *Windward*, the Danish Government having qualified their permission to land at the Greenland ports with the condition that tourists should not be carried. Mrs. Peary and Miss Peary, however, will go North on the steamer as far as Etah, and it it probable that the *Windward*, if she returns will bring home the Robert Stein party, landed near Cape Sabine by the *Diana* in August last.

MAP NOTICES.

BY

HENRY GANNETT.

Since our last notice the U. S. Geological Survey has issued a number of new atlas sheets representing different parts of the country. Five of these are in New York State, all being upon the scale of 1:62,500, with contour intervals of 20 feet. Indian Lake represents an area in the southern part of the Adirondacks, including the lake of that name, embosomed in high mountains. The Tully, Cazenovia and Salamanca sheets represent portions of the dissected plateau toward the western part of the State; and the Silver Creek and Westfield sheets represent the shores of Lake Erie.

Parts of Ohio and Kentucky are represented in three sheets, known as the East and West Cincinnati and Ironton, on a scale of 1:62,500, with a contour interval of 20 feet. The last named lies almost entirely in Ohio, and represents a dissected plateau of no great relief. The others, which adjoin one another, represent the cities of Cincinnati, Covington and Newport, with adjacent portions of the two States. The general surface of the country is broken and uneven, with the Ohio River flowing mainly in a narrow valley; while the Great and the Little Miami, with sinuous courses, meander through broad valleys to their junction with the master stream.

In Illinois there is one sheet, Evanston, showing that suburb of Chicago and a portion of the lake shore.

In South Dakota there are two sheets, Spearfish, showing the northeastern slopes of the elliptical mass of the Black Hills, and Alexandria, representing a portion of the level glaciated valley of James River. The scale of these sheets is 1:125,000, and the contour interval 20 feet.

In Nebraska are two sheets, St. Paul and Sidney, on a scale of 1:125,000, and a contour interval of 20 feet. The first is traversed from west to east by Loup River, formed in the western part of the area by the junction of its north and south forks. These, with the main stream, flow in a broad valley, in gentle slopes, and are nearly graded. Platte River flows across the southeastern corner of the area in a valley of great width and extremely level. The area between the valley of this stream and the Loup is largely filled with sand-hills, while north of the Loup the country is somewhat broken, eroded prairie. Sidney sheet lies farther west. Its area is traversed from west to east by Lodgepole Creek, a tributary to the Platte, while across its northeast corner flows North Platte River. The area is mainly composed of a high, semi-arid prairie, breaking down toward the north in the valley of the North Platte in irregular hills.

In Idaho is one sheet, Sawtooth, on a scale of 1:125,000, with a contour interval of 100 feet. It is a region of high mountains, rising to altitudes exceeding 11,000 feet, and drained in the main by Wood, Boise, and Salmon rivers.

Among the special maps issued by this office is one designated Menominee. This includes a part of Dickinson County, in the Upper Peninsula of Michigan, in which are the mining towns of Iron Mountain and Norway. The types of topography occurring here are those produced by the erosion of the Laurentian Glacier—irregular, broken hills, crooked streams, with many lakes and marshes. The scale is 1:62,500, and the contour interval 20 feet.

The first of a series of land classification maps have been issued by the U. S. Geological Survey. These represent quadrangles about Seattle and Tacoma, Wash., and show, by tints and conventions, the areas naturally without timber, those covered with woods and with virgin merchantable forests; areas from which the forests have been cut, and those upon which they have been burned. The two latter classes are subdivided into those upon which forests are being restored or not.

Upon the backs of the sheets are printed short descriptions of the areas, and statistics of the different classes of land and the stand of timber.

These areas lie mainly along the west shores of Puget Sound, and were originally almost entirely covered with fine merchantable forests. Lying near the coast, they are among the most densely settled portions of the State, in which lumbering has been extensively carried on in wholesale fashion for many years. As a natural result, a large proportion of the territory has been denuded of its merchantable forests, and another large part has been burned by fires, which, starting invariably after cutting, have spread into the adjacent forests; but, owing to the heavy rainfall prevailing in this region, the destruction of the forests, whether by fire or the axe, has been followed by a re-growth everywhere, excepting upon the cultivated lands.

It is, we understand, the intention of the Geological Survey to publish similar sheets of large parts of the United States.

Atlas de Finlande. Société de Géographie de Finlande. Helsingfors, 1899. 32 double folio plates.

This is a physical, statistical and industrial atlas of Finland. It contains a general map of the province, a relief map, showing elevation by shades of one color, in the manner commonly in use for that purpose; a petrographic map, showing the distribution of rocks; a Quaternary map, showing glacial erosion and deposition; a series of maps illustrating the elements of climate, and numerous maps showing the distribution of plants, together with forest distribution. Following these are many maps and diagrams exhibiting statistical facts relating to population, agriculture, mining and manufactures. The means of transportation are illustrated by maps, showing wagon roads, railroads, telegraph and telephone lines, with diagrams illustrating transportation statistics. The atlas closes with maps, showing the distribution of works of prehistoric peoples, and a series of historical maps of the country. Taken altogether, it contains a vast deal of information concerning a little-known part of the earth.

WASHINGTON LETTER.

WASHINGTON, June 20, 1900.

The geological and topographical surveys in progress in various parts of Alaska, under the U. S. Geological Survey and U. S. Coast and Geodetic Survey, are to be continued at three points during the ensuing season. The greater part of the work is in the Seward Peninsula, the large body of country between Kotzebue Sound and Norton Sound, forming the westernmost extension of Alaska. It is at present the focus of interest of the whole territory, since on one of its southern points lies the Nome district, and farther north, on the coast, nearly as far as Bering Strait, and opposite Port Clarence, the newly opened gold district of Cape York. Inland, still farther to the north, and in the direction of the neck of the peninsula, lies the unexplored extension of the Cape Nome gold-bearing belt.

The plans of the U. S. Geological Survey include the examination of the Nome region and environs and reconnoissances of the trend of the gold-bearing belt, working both from the north and south. Aside from work on the Seward Peninsula, the Geological Survey has placed a party in the Copper River district, and will store supplies on the Koyukuk River, in preparation for an Arctic exploration in the summer of 1901.

The Coast and Geodetic Survey is sending two steamers to survey the southern coast of the Seward Peninsula, and also two parties to different points on the southeastern coast of Alaska. The survey of the southern coast of the peninsula will be conducted by the steamer *Pathfinder* from Cape Nome to St. Michaels, and by the steamer *Patterson* to Cape York and Port Clarence. Especial attention will be given to the examination of harbor facilities for Cape Nome and Cape York. The work on Golofnin Bay, which was begun last year, will be completed, and the coast to the east examined by the *Pathfinder*. The work at Cape Nome is of special importance, because the region has not yet been visited by Government surveyors. The *Pathfinder* started from Seattle June 13, carrying, besides its officers, the members of the Geological Survey parties.

The Geological Survey force which is to work on the land area adjacent to the waters traversed by the steamer *Patterson* consists of a topographic party in charge of Mr. E. C. Barnard and a geological party under Mr. Alfred Brooks. The region covered by this party is the gold-bearing country in the southern part of the Seward

Peninsula, between Cape Nome and FishRiver and Port Clarence—an area of from three thousand to four thousand square miles. It is to be surveyed on a scale of 4 miles to the inch, producing a map similar to that of the Fortymile Quadrangle surveyed in 1898. A complete triangulation from Golofnin Bay to Port Clarence is to be carried through for the benefit of the Coast and Geodetic Survey. The party under Mr. Brooks will make a reconnoissance of the new Cape York district, a special study of the extent of the gold-bearing formations, and the condition of occurrence of veins from which the placer gold of the foothills and river valleys back of Nome is derived.

The great gold-bearing belt whose southwestern termination has been opened up in the vicinity of Nome appears to extend across the Seward Peninsula in a general northeasterly direction towards the Good Hope Bay and Keewalik River. The party which has for its especial object the reconnoissance of this belt will be landed on Good Hope Bay by one of the Coast Survey steamers as soon as the ice breaks and will then work southward. It consists of Mr. W. J. Peters, topographer, and Mr. W. C. Mendenhall, geologist. They will survey the northeastern part of the Seward Peninsula, returning across the neck by Buckland Bay to Norton Bay.

Last season the headwaters of the Koyukuk and Gens de Large rivers, in the comparatively unknown northwestern part of Alaska, were explored by a Geological Survey party. It is proposed to prepare this summer for exploration in 1901 of the country lying within the Arctic Circle, between the Koyukuk and the Arctic Ocean. In order to accomplish this object, it is important to leave the Yukon sufficiently early in the season to return before the ice closes in the fall. If supplies are cached on the Koyukuk this season, a party with a light outfit can come in by sledge the following winter, ascend the rivers on the ice early in the spring, and come out after the ice is broken up. The supplies are to be stored at the mouth of the Allenkakat River, which is just within the Arctic Circle, and the proposed route follows up the Allenkakat to the divide by which it heads against streams flowing north to the Arctic Ocean. Thence the party will proceed down some stream to the ocean and along the coast west and south until picked up by a steamer.

In the southeastern part of Aláska the Coast and Geodetic Survey will have the steamer *Gedney* doing coast pilot work, and a party under Mr. H. D. Ritter at Prince William Sound. The latter will carry on triangulation, coast-line surveys and hydrographic work.

During the summer of 1899 indications of copper were discovered by the Geological Survey party which made a reconnoissance of the headwaters of the Copper, Tanana and Nebesna rivers. The chief copper districts are the valley of the Chettyna, a western tributary of the Copper River, south of the Wrangel Alps, and the region about the headwaters of the Copper and Nebesna rivers north of the Wrangel Alps. This season a topographical and geological survey will be made of the Chettyna River district. It is an area of 3,000 square miles, and the map will be on a scale of four miles to an inch. The party, which left Seattle on May 30, consists of Mr. T. G. Gerdine, and Mr. F. C. Schrader, geologist. This area will also be connected with the work done by the Coast and Geodetic Survey on the coast near Valdes, and a geological exploration will be carried through, if possible, between the valley of the Chettyna and the south coast parallel to it.

In the United States proper, the usual work of the Geological Survey will be continued in various sections, and in some localities the advance will be more rapid than usual, on account of co-operation with State surveys. Considerable work will be done in New York, Pennsylvania, Ohio and Maine. This latter State co-operated for the first time in 1899. This is also the first season that Ohio has co-operated, and plans are made for the completion of one or two atlas sheets in that State. Plans for co-operation with California are to be placed before the State Legislature next winter. One work of especial interest is the continuation of the survey of the line between Idaho and Montana, from the international boundary to the crest of the Bitterroot Mountain range.

On the eastern shore of the country the Coast and Geodetic Survey will carry on coast and harbor examinations at four points. The steamers *Eagle* and *Bache* will work in Chesapeake Bay. The *Bache*, until July 1, will survey the lower part of the bay, conducting a hydrographic examination from the mouth of the Potomac to the capes, preparing the triangulation as a base for topography. In June the *Blake* came up from Porto Rico, where she has been engaged all winter, and will conduct a survey on Savannah River. The Savannah Bar will be examined and a deep-waterway sought. The *Matchless*, also from Porto Rico, will conduct an examination of the old channel entrance to Charleston Harbor. Some work will be done also at Portsmouth Harbor.

On the west coast of the country, Puget Sound at Seattle and Port Townsend will be examined by the *Gedney* before her departure for Alaska, and the steamer *McArthur* will examine the bar outside the Golden Gate at San Francisco. On August 1 a party will be sent to carry on hydrography and topography at the mouth of the Columbia.

The western forest reserves, of which an examination has been carried on during the last three seasons by the Geological Survey, under the charge of Mr. Henry Gannett, will be further studied this season. Over half of the total area of the reserves has now been examined, and a report of the work during the season of 1897 has appeared as Part V of the Nineteenth Annual Report of the Survey. The results of the work of the season of 1898 are in the hands of the public printer, and a report of the work of 1899 is in course of preparation. Last season the whole of the Lewis and Clark Reserve was examined, and the Mt. Rainier Reserve completed. Work was also done in the Olympic, the southern part of Cascade and Ashland reserves, and an examination was made of the Yosemite National Park and Stanislaus Forest Reserve, which adjoins the park on the north. The present season's work will be to examine the country north of the Stanislaus Reserve. From this region the timber was removed during the early mining days in California, and it is especially desirable to determine to what extent new growth is coming up. Other regions which will be examined this season are the country between the Mt. Rainier and the Washington reserves in Washington, with a view to reserving also that area and so including the whole Cascade range. The examination of the Olympic Reserve will also be completed this year.

The Division of Forestry of the Department of Agriculture, during the present season, will be concerned largely with the effect of sheep pasturing on land which is suitable for the growing of timber. Mr. Gifford Pinchot, the Chief of the Division, is making an examination of various lands in which sheep are pastured in Arizona and New Mexico, hoping to establish beyond a doubt whether or not land is rendered worthless for subsequent growth of timber by sheep pasturage, and how much the young growth is injured by the passage of the flocks. Other parts of the Western States are being examined by Mr. Pinchot's assistants.

The water resources of the United States are also being studied systematically by the hydrographic branch of the Geological Survey. The appropriation for this purpose has been increased from $50,000 to $100,000, and a number of important reservoir sites will be surveyed in the West, in addition to the stream measurements carried on throughout the entire country.

The demand for official data concerning the available water power on various rivers is notable as showing the rapid utilization of these, especially through electrical transmission of power. Examinations have already been begun of the headwaters of Kings and San Joaquin rivers in California, Truckee River in Nevada, and Milk River in Northern Montana. Close co-operation is had with the Forestry Division in the study of the effect of forests upon the water supply, and for this purpose a joint reconnoissance is being made of the southern Appalachian forest area; the character of the forest growth and its value is being determined by the Forestry Division, and the volume and fluctuation of the rivers issuing from its area is being studied by the Division of Hydrography. N.

THE RESULTS OF THE CUBAN CENSUS.

BY

HENRY GANNETT.

The main results of the Cuban census taken last October have been given to the public in the form of three bulletins, by the director, General J. P. Sanger. These contain the figures and a discussion of the more important aspects of the population. The first bulletin relates to the total population, showing the increase and decrease since the last census taken by Spain, the density of population and its urban and rural elements. The consideration of these statistics is prefaced by an account of the division and organization of the island for local government. Bulletin No. II presents the statistics of nativity, birthplace, citizenship, sex, conjugal condition, age and literacy. The third bulletin gives literacy and citizenship statistics in detail, and was made up especially in connection with the recent municipal elections in Cuba.

The latest Spanish census of Cuba was that of 1887. By this count the total population of the island was 1,631,687. By the present census the total population was 1,572,797. The numerical loss in the twelve years amounts to 3.6% of the population in 1887. This is only a part of the actual loss, however, for allowance must be made for the normal increase of the population up to the beginning of the war. In reality a population of little less than 1,800,000 in 1895 was reduced in the following five years by the war and reconcentration policy to the present numbers—a loss approximately of 200,000 people.

The figures showing the distribution of this loss over the island and the distribution of the races and ages will be more easily appreciated if the political division of the island is understood. The whole island is divided into six provinces, these into 132 *términos municipales*, which may possibly correspond to counties, and these into smaller divisions termed *barrios*, which may be translated wards, and which number from eleven to twelve hundred. The province of Pinal del Rio, at the extreme western end of the island, is in part mountainous, and adjoins Havana, which is characterized by containing the large capital city. Matanzas on the east is followed by Santa Clara, both agricultural and rather thickly populated, and the eastern end of the island is occupied by the sparsely populated and pastoral provinces of Puerto Principe and Santiago de Cuba. The municipal districts, into which these provinces are divided, are the principal administrative and political civil divisions of the island, and have been used as the census unit. The whole of each municipal district is divided into barrios in such a way that no distinction is made between the cities and the rural districts, and this has led to some difficulty in defining the limits of cities.

The loss of population has not been distributed evenly over the whole island, but on the contrary three of the provinces have gained in numbers since 1887. These are Puerto Principe, which increased 30.2% of its population in 1887; Santiago, which increased 20.3%, and Santa Clara, which increased 0.7%. Certain districts in other provinces showed a decided increase, among them the municipal district of Havana, which contains the city. This district gained to the extent of 20.7%; while the province outside the district of Havana suffered a loss of 15.2%. Pinar del Rio and Matanzas, on either side of Havana province, lost respectively 23.4% and 21.9%. In general, the part of the island which sustained the heaviest loss was that in the region of the centre of hostilities. The gain in the eastern part was due to its being at a distance from the scene of the struggle, and also probably to the migration of people away from the western provinces. The gain in Havana district was caused by the reconcentrados, who were collected from the surrounding rural parts of Havana, Matanzas and Pinar del Rio, and the great loss in these provinces is due to their almost complete depopulation at that time.

The average number of inhabitants to each of the 44,000 square miles of Cuba is 35.7, which is about the same density as the State of Iowa. Great diversity in this respect is seen among the several provinces, whose density of population varies from eight inhabitants to the square mile in Puerto Principe to 153 in Havana. The density of the rural population, when cities of 8,000 inhabitants or more are omitted, ranges from 6 in Puerto Principe to 55.3 in Havana province. Santiago has a scant rural population of only 21.7 to the square mile, and Matanzas and Pinar del Rio, on either side of the thickly populated Havana, have densities of 39 and 32.8 respectively. Puerto Principe is the principal grazing region; Matanzas and Santa Clara contain most of the great sugar plantations, and Pinar del Rio is the principal region of tobacco culture.

The number of large cities in Cuba has always been remarked, but the high percentage of the population which the returns of this census have shown to be urban is a matter for surprise. Cuba has a larger proportion of its people living in cities of 8,000 and over than the United States, 29.2% of the population of this country belonging to this class in 1890, while in Cuba the proportion is 32.3%. Including all cities down to 1,000 inhabitants 47.1% are urban in Cuba. In the different provinces this proportion varies from 77.4% in Havana, 51.2% in Matanzas and 40.1% in Puerto Principe to 33.2% in Santiago and only 12.9% in Pinar del Rio. The number of cities of 1,000 inhabitants or more, which it is possible to give separately, is 96. Of these 16 have a population of 8,000 and over, 5 a population in excess of 25,000, and one, Havana, a population of 235,981.

To Bulletin No. I is appended Table I, which gives the population of Cuba by provinces, municipal districts and barrios, and Table II, containing a list of the cities of 1000 and over, with their populations.

The results of the census concerning race, sex and age of the Cuban people have brought out most interesting conditions. The whole population has been divided into five race and nativity classes, viz., native whites, foreign whites, mixed, negro and Chinese. The present census establishes the fact that in every province in Cuba the native whites are in a majority. This fact has an especial bearing on the suffrage restrictions which have been made in the island, and it has been fully discussed in Bulletin No. III. Native whites are, proportionally, especially numerous in Puerto Principe, the pastoral province, and in Pinar del Rio, parts of which are rather inaccessible to the colonizer. In the city of Havana, owing to the large element of foreign birth, they formed a trifle less than half, 49%. The native whites are 57.8% of the total population, the colored, including mixed, amount to 32%, the foreign-born to only 9% and the Chinese to less than 1%. The colored element is less strong than has been supposed, and the records show that the proportion has steadily decreased in the last hundred years, as in the United States. Forty years ago the colored population is known to have been three-fourths males, and by the present census it is more than half females. The early excess of males was due, of course, to the constant supply of male slaves brought in, and the present population consists of a new generation, which is in the normal ratio. The colored were in largest numbers in Santiago, where they were 45%, and least numerous in Puerto Principe, which contained 20% colored. In Havana city they were 27.3%. The Chinese also have steadily decreased—from 34,834, in 1861, to 14,857 at present. The foreign-born are centred in Havana city, in which they are 22.4% of the entire population. They grade away from the city in the following ratios: 8.8% in the rural portion of Havana province, 7.5% in Matanzas and 6% in Pinar del Rio; in Puerto Principe the proportion is very small, and in Santiago it is only 4%. The key to the situation is found in the fact that the Spanish population, which is three-fourths of the whole foreign population of the island, is also concentrated in the city of Havana, being 20% out of the total of 22.4% foreign-born; the proportion of the foreign born which is not Spanish steadily increases with remoteness from Havana. The fact is, the Spanish came to the island principally in political interests and the other foreign whites for commercial and agricultural purposes. The figures on citizenship appear rather diverse when compared with the race statistics: 83% of the entire population claimed Cuban citizenship, only 1% Spanish and five per cent. other than Spanish or Cuban; 11% were recorded as being in suspense, having not yet signified their intentions. Apparently 5% out of the 88% of the Cuban-born are citizens of other countries, being the children perhaps of foreign-born, and only 1% out of the 9% of Spanish birth are Cuban citizens, the remainder being classed mostly with those in suspense. The foreign citizens were bunched in Havana city and the purest Cuban citizenship was found in Santiago. Citizens of countries other than Cuba and Spain were twice as numerous in the rural part of Havana province as in the city [11.6% as opposed to 5.3%].

A constant characteristic of the population of Cuba since 1775, as quoted by Humboldt, has been an excess of males, caused by the fact of the island's belonging to the class of countries exploited to a large extent by foreigners. In fact, the only races showing an excess of males are the foreign white and the Chinese; the mixed, negroes and native whites all having an excess of females in the census of '99. This race distinction is further emphasized by the fact that since 1887 the number of males and females have apparently changed in opposite directions, that of the females increasing 14,924 and that of the males decreasing 51,202. The loss of males is due, of course, partly to the return home of foreigners, driven away by the disturbances, although reduction in the number of native males, consequent on the war, has had its share. The excess of males is greatest in those western provinces where the foreign element is strongest. The total excess of males is 57,613, or 3.6% of the entire population. Cuba differs from Jamaica, Porto Rico and the Bahamas in this respect and resembles the United States.

The conjugal condition of the Cubans is characterized by a smaller proportion of married than any European country or the United States. There is present also in Cuba a third class, which is found in some Catholic countries where canonical marriage is difficult and expensive, that is, people participating in unions by mutual consent only. By the present census for the first time this class has been recognized and the statistics counted in with the true marriage statistics. The proportion of those participating in these unions varies from 4% of the total population in Puerto Principe to 12% in Santiago, and varies indirectly as the percentage of regular marriages, which range from 12.4% in Santiago to 19.5% in Puerto Principe. The two classes together give a married population of less than one-fourth [24.1%] for the whole island—a proportion much smaller than in the United States, where it was 35.7%, and even smaller than in the State which had the lowest percentage, Arizona, with 30.7%.

The age statistics are found to emphasize strongly the effects of the island's painful struggle. Not only is there a large deficit in children born in the last five years, but adults and old people are in smaller than normal numbers. These deficiencies follow the gain and loss in numbers of the total population. The percentage of children under five varies from 11.1% in Puerto Principe and 9.8% in Santiago to 7.9% in Matanzas and 7.3% in Havana. In the city of Havana it was 7.6%, and in the rural portion of the province it was only 7.1%. The average for the whole island was only 8.3%; while in Jamaica it was 13%, in Barbados 13.6%, and in the United States 12.2%; from the figures of the last Spanish census of Cuba, which gave age statistics [that of 1861], it is possible to estimate the normal percentage in Cuba of children under five, and this is found to be 12% of the total population. This indicates "a deficiency of about 60,000 children under five, which must be attributed to recent events in the island." The deficiency in old persons is due to other causes than the war.

> "The per cent. of the population belonging to this group was 14.2, while in the United States it was 17.2. But this relatively small number of elderly persons in Cuba is not a new characteristic. Indeed, in 1861 the proportion was somewhat less. It probably results from unsanitary conditions, ignorance regarding care of health, and poverty, all of which are widely prevalent among certain classes in the island. These causes operate to produce short average duration of life, and have perhaps been reinforced by another, the depletion of the age class of over 45 among the foreign-born through their return to Spain, China or elsewhere after their work in Cuba is over."

The percentages in the age groups of from 17 to 20 and 21 to 44 are about equal to the same in the United States, and that there is a deficiency in these groups appears only from the fact that the age groups of under 5 and over 45 are also small. The age group which appears to have suffered least from the war, and which comprises four-fifths of the extra percentage, is that of school age, 5 to 17.

> "These children represent the survivors of those born in Cuba between 1882 and 1894, together with a negligible number of immigrants."

They were 35.2% of the entire population, and, compared with the same class in the United States, would give 119 children where the United States would give 100. They appear to be distributed among the provinces much as are the children under five, except that it is Havana city that has the fewest instead of the province outside.

In connection with this class of children of school age, which is so large at present in Cuba, it is of interest to examine the school and literacy statistics. Only 16.3% of these children attended school the year of the census. The proportion of the total population over ten years of age who could read was 43.4%—rather more than two-fifths. Comparing this with the percentage of literates in the last two Spanish censuses of Cuba, it is found that there has been a steady increase:—1861, 19%; 1887, 28%; 1899, 36%. The illiterates are distributed in the provinces according to the percentage of urban population, and vary from 38.8% in Havana and 50.9% in Puerto Principe to 65.8% in Santiago and 76.2% in Pinar del Rio. In Bulletin III the literacy of the male population of voting age is shown by race and nativity, and is found to be distributed as follows: of the white Cuban citizens 51% were unable to read, of the colored Cuban citizens 74% were unable to read, and of the Spanish citizens 12% were unable to read. This disparity between the races is not enough, however, to give the foreign voters a majority in any of the provinces. It has been found safe to abide by the provisions of the election laws, which gave the suffrage only to those who could read and write, or to owners of $200 property, or to soldiers in the Cuban army. The following table sums the subject up.

Proportion of literate males of voting age who were born in Cuba to all literate males:

[Province.]		[Province.]	
Havana City	45%	Havana [excluding city]	66%
Pinar del Rio	59%	Santiago	70%
Matanzas	61%	Puerto Principe	76%
Santa Clara	63%		

BOOK NOTICES.

The Norwegian North Polar Expedition, 1893–1896. Scientific Results, edited by Fridtjof Nansen, Volume 1. Published by the Fridtjof Nansen Fund for the Advancement of Science. Christiania, Jacob Dybwad; London, New York, Bombay, Longmans, Green, and Co.; Leipzig, F. A. Brockhaus. 1900.

Dr. Nansen says in his preface:

> In order to place the various Memoirs before the scientific world at the earliest possible date, they are printed as they are finished, without regard to the systematic sequence, and they will be published as soon as there is sufficient material to form a volume. Each Memoir will be paged separately, and will be given a number, running continuously from 1 through the whole series, by which it may easily be referred to.

This first volume contains five Memoirs: a description of the *Fram* by her builder, Colin Archer; the Jurassic Fauna of Cape Flora, Franz Josef Land, by J. F. Pompeckj, with a Geological Sketch of Cape Flora and its Neighbourhood by Fridtjof Nansen; Fossil Plants from Franz Josef Land by A. G. Nathorst; An Account of the Birds by Robert Collett and Fridtjof Nansen; and the Crustacea by G. O. Sars. In all, there are forty-six plates.

It is estimated that the work, which will be issued only in English, will form five or six quarto volumes, and will be finished in the course of about two years.

It is Dr. Nansen's intention to give, at the close, a complete summary of the scientific results.

As a specimen of printing the book deserves the highest praise, and the text is remarkably free from errors of the press.

Glacières or Freezing Caverns. By Edwin Swift Balch, A.B. (Harvard); F.R.G.S., Member of the Franklin Institute, of the Appalachian Mountain Club, etc. Philadelphia, Allen, Lane & Scott. 1900.

Mr. Balch first became acquainted with subterranean ice in September, 1877, while descending King's Ravine, on Mount Adams, in the White Mountains of New Hampshire.

Since that happy day he has visited ice-caves in various countries and has made notes of his reading on the subject, to the advantage of those who look into his handsome book.

The first hundred pages are devoted to what are called Experiences in Glacières, well described and illustrated by cuts from photographs and drawings of sections.

Sixty pages are devoted to a discussion of the causes of subterranean ice, with a preliminary consideration of the terminology of the subject. Mr. Balch finds that, so far as he knows, the only correct, generic term for subterranean ice-formations is the French word *glacière*, and he goes on to say:

> It might be well, therefore, if the French term *glacière* were adopted as a generic term for all underground ice-formations. As, however, there is little likelihood of this happening, the question arises as to the best English equivalent or equivalents.

The French word seems to be in the way of adoption. It is familiar to English scientific writers, and it is recognized by at least three authorities: Stormonth's Dictionary, the Century and the Standard.

The popular belief that the ice of caves is formed in summer and melts in winter is partly founded on the fact that the temperature of caves is colder in summer and warmer in winter than the outer air. It is to be remembered also that the *glacières* are rarely visited in the winter season. Prof. Thury, intending to visit one cave in mid-winter, was told that he would lose his time, for there would be no ice in the cave. He went by himself and found the *glacière* full of hard ice. His report staggered the peasants; but one of them at last spoke for all:

> "It makes no difference; in genuine *glacières* there is no ice in winter."

The list of *glacières*, pp. 165–265, is made to include too many mere names, with the added remark: *No information.*

These and the notices of subsoil ice in the tundras of Alaska might have been omitted with advantage.

A bibliography and an index bring the work to a close.

ACCESSIONS TO THE LIBRARY.

MAY–JUNE, 1900.

BY PURCHASE.

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GIFTS.

From Edwin Swift Balch, A.B., Author:
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CHARLES P. DALY,

President of the American Geographical Society,

May 5, 1864—September 19, 1899.

From the portrait by Harper Pennington.

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MADAGASCAR.

BY

W. H. HUNT, TAMATAVE.

THE ETHNOLOGY OF MADAGASCAR.—The great questions which have puzzled everyone who has thought much about the matter are: Where did the first inhabitants of Madagascar come from? To what race or races do they belong? Undoubtedly the prevalent idea is—and at first sight such would appear the case—that the population of Madagascar consists of a mixture of very opposite races. I shall attempt in this article to examine the *pros* and *cons* of this theory. At the very outset we are confronted with the derivation of the names Madagascar and Malagasy, for it is certain that the Malagasy never called themselves that, nor their country Madagascar. Formerly divided into many tribes, having no political or even commercial relations with each other, they could not possibly have a common term to designate collectively the inhabitants of the whole island. Each tribe had a name the etymology of which gave some insight into its origin, or in many cases only indicated the geographical features or position of its restricted territory. Thus as examples of the latter we have the *Betanimena*, which means "The many inhabiting the red soil," a strip of the east coast. On the northwest coast we have the *Antankarana*, signifying "The inhabitants of the reefs," designating the history of a tribe which at some early period was driven to take refuge on a rocky part of the coast. Other tribes adopted a name the etymology of which is rather political. Thus *Betsimisaraka*, applied to almost all the east coast, signifies "The many who do not separate," or as we might say, "The great Inseparables," pointing to a time when there was a necessity to unite in common defence against some other tribe. So again the *Betsileo*, second only in numbers to the Hovas and occupying the southern central highlands, might be translated "The great Invincibles." The *Hovas*, or, as properly written, the *Hova* (for Malagasy words take no plural), who are the dominant tribe, and whose country they call *Imerina*, apply to themselves the more pompous political denomination *Ambanitanitra* (the people under heaven); but the origin of the word *Madagascar* is more or less a mystery. The Portuguese and Dutch who first came to the island merely denominated the natives *blacks*. Very ancient authors have called them after Arabs of the coast of Africa, in particular *Bouké*; but this name could only have been local, applying to the west coast natives, for the Arabs knew nothing of the country considered in its entirety. The English in the 17th century never use any other term than *Natives;* but that distinguished and eminent authority on Madagascar, *M. Grandidier*, maintains that it is the French who introduced the general name of *Madagascarins* or *Madagascarois*—a name given in atlases of the 16th century to the island. It must be admitted that we are not much further advanced as to why that name was given or whence derived, but it gradually gave the words *Madécasses*, *Malégasses*, afterwards written *Malégaches* and now *Malgaches*, and the English and native form *Malagasy*.

Hence it is seen that the etymology of the word Malagasy, as well as of the names of the different tribes, gives little or no clue to the ethnology of these peoples. Traditions as to the arrival of them in the island are deplorably incomplete. In a paper written in 1894 by an Englishman long resident in the island, he succeeded in carrying the history of the *Hovas* as far back as 1680, but he gives not the slightest trace of when they first arrived in the interior; and even they found another tribe, the *Vazimba*, which they exterminated, and were themselves divided into bitter factions; nor was it until 1780 they formed a united tribe called *Hova*. However, by dint of studying the types from an anthropological and physical point of view, as well as by examining their manners and customs, religious beliefs, their employments, industries and mode of architecture, and last, but not least of all, their language, much has been done to clear up these questions.

It has now been clearly established, thanks to the scientific researches of M. Grandidier, that we can be certain of three very distinct ethnical groups of immigrants into the island of Madagascar; but it does not follow that either of them was very large, and they alone will not account for the whole population. First, there were the *Andriana* or Nobles of Imerina, who forced their way up to that central plateau, found it peopled by a tribe called the Vazimba, exterminated these latter, and became what are generally known as the Hova, though I cannot tell from where came the erroneous denomination. The second well-defined group are the *Antaimoro*, occupying the southeast coast, and the third are the *Antalaotra* of the northwest coast. History has now generally established that the first-mentioned group are of Malay origin, driven on to the southeast coast on that very part already occupied by the *Antaimoro*, the second-named group, who nearly exterminated and drove the remnant to take refuge in Imerina. At what period this took place it is difficult to determine; it required some centuries at least in order to enable a small, harassed and detested band to develop more than a million population, shut up in their mountain fastnesses until the close of the last century (1780), when they in turn became the dominant tribe. No one who has seen them can doubt their Mongolian origin, being immigrants from the great Indo-Chinese family. From this, for years and years, writers maintained that the mass of the Malagasy population, who are blacks, must be of African origin. It is so easy to theorize on the subject; Madagascar being so near to the African coast, all the black population must be of African origin! When interested some time ago in the question and confronted with this theory I invariably expressed myself as not satisfied, for the uniformity of the language throughout the whole island demanded an entirely different explanation on the ethnology of Madagascar. How could a small band of Malays, almost exterminated on their arrival on the coast and then driven into the interior, where they lay unknown for centuries, having no communication with the rest of the island, have implanted their language over the whole island? Do not vocabularies, collected by sailors and others on all parts of the coast, long before the Hovas were known to exist in the interior, conclusively prove that there has never been but one language in Madagascar? But such questions were always shelved as irrelevant. The Hovas must be Malays and all the blacks Africans, said the old school; just as if there existed no black Indo-Melanesians who could have come to Madagascar before that particular tribe of *Andriana*, who are the ancestors of the Hovas, as now called. The mixture and crossing of races in Madagascar begets such utter confusion that the error was quite possible. We have Malays, Indo-Melanesians, Makoas, Arabs, Swahili, Indians, and perhaps some Chinese, but to find any one individual of these pure would now be almost impossible; all the Malagasy, or nearly all, are cross-breeds of one kind or another; nevertheless, through all this complex hybridism the fundamental characteristics of the race which from the beginning formed and ever since has formed the basis of the population on which the other above-mentioned races have been grafted at different periods and in different proportions, and especially the language, on which I lay most stress, must prove that the first immigrants to Madagascar, black though they must have been, point to an Indo-Melanesian origin. It is true that the Oriental negroes, that is, those of Asia and Oceanica, belong to several types, the difference in stature and build being very marked; but there is invariably a uniformity in customs and social development, while their intellectual and moral traits are almost identical. Then, again, these have crossed with Polynesians, producing other types so varied that old writers, basing themselves on certain exterior characteristics, such as the hair and the color of the skin, have attributed to them an African origin.

The same error, quite naturally and more easily, took root as regards the blacks of Madagascar, probably nurtured by the ever predominating fact that Madagascar is so close to Africa and so far from Asia; but a short examination of the matter will immediately throw a different light upon it. The tribes of the coast of Africa were never a sea-faring race, and the currents in the Mozambique Channel are such as to render the passage from Africa to Madagascar exceedingly difficult, whereas the Indo-Malays are renowned navigators and the currents are favorable for descent on the coasts of Madagascar, whether by purpose or accident. Malay junks have on several occasions been met with on the shores of Madagascar, and I am informed that, after the volcanic eruption of Krakatao in 1883, the shores of Tamatave were strewed with pumice stone.

All these facts lead us to conclude without doubt that Madagascar was peopled by *successive immigrations* of Indo-Melanesian negroes long before the arrival of that one particular band of Malays who, by their lighter color and later superior civilization, led former writers into the error that they alone formed *the* Asiatic element, and all the rest, being black, must be Africans. It is also now certain that these earlier successive immigrations brought the language into the country; for, as discussed above, that later tribe, puny and nearly crushed out of existence, could not have implanted its language over an island 900 miles long which it only partly overran during the last 80 years, but which has never had but one language. Then, again, the physical traits, manners and customs of the different Malagasy tribes are not so different as at first sight appears. Now that scientists have been able to eliminate the engrafted elements mentioned above and avoid being misled by the differences of plaiting and doing up the hair existing in different provinces, which accounts for a seeming difference of features, or by the slight difference in customs consequent upon intermarriage and the nature of the part of the country in which they lived, the conclusion has been reached that great uniformity exists, and that that uniformity declares an Oriental origin. The first immigrations to Madagascar may have been at the time referred to by Baron d'Eckstein in discussing the origin of the negroes of Oceanica, whose dispersion from the Malay Peninsula took place 2,500 years B. C., when fleeing from the Aryan invasion. A part of these, instead of dispersing to the East, may have been carried westward and fallen on the shores of Madagascar.

Finally, having sufficiently shown that the basis of the population of the whole island of Madagascar is Oriental, whatever may have been the date of the very earliest immigration, the question may still be asked: But did not these very first immigrants find the island inhabited by another race, the issue of African immigrants?

M. Grandidier says that in the present state of our knowledge it is impossible to answer this question. If there were aboriginal inhabitants when these Asiatics arrived, they must have been in very small numbers and in a very low state of civilization, for neither in the customs nor in the language of the present Malagasy are any traces of their influence to be found. Words of foreign origin, both African and Arab, abound in the language, but they merely float on the top of the Malayo-Polynesian, as detached names of things, in proportion as these have been introduced in the same manner as English or French words are introduced every day at present; but these do no affect the language. In some parts of the island where fossil bones of extinct animals have been discovered, fragments of pottery have been found which are not the work of the present inhabitants, but probably of some ancient colonies or unknown races which no longer existed even at the time of the very first immigrations from the Malay Peninsula; for these potteries denote a sufficiently advanced state of civilization, and the people who could make such would not be likely to have been absorbed by these new arrivals who came in their junks in disconnected and small numbers, unless these latter could have had time to settle and multiply to such an extent as to exterminate the natives. There is no trace of anything of the kind having happened, and, moreover, it is difficult to conceive the total disappearance of an already civilized people. The most that could happen would be their reduction to slavery, and in that case they would have left their impress on the customs and language of the conquerors.

To sum up the argument of this paper, it is well established to-day that the people of Madagascar are one, in the sense that they are all of Asiatic origin, but consisting of successive immigrations dating very far back; that the Hovas are comparatively a later immigration, and only one of many others; that the African element claims no more title to a basis of any part of the population than the other floating foreign elements that have been engrafted on the main trunk without materially affecting the uniformity of the customs, manners and language of the whole country.

There is still much to be learnt from an anthropological and ethnographical point of view; but it is now generally admitted that, thanks to such scientists as Grandidier, the notions we possess on the origin of the Malagasy are sound and have dispersed the false ones so long existing.

In the foregoing paper I have developed what are now the generally scientifically approved theories of the ethnology of the Malagasy people. As a fact we know more of the people than of their country. The natives of a country, still wild and unknown, come down little by little to the sparse European settlements; but before the Europeans in their turn can visit any considerable part of the island two things are primarily indispensable: some geographical knowledge of the country and means of communication or conveyance. I will not speak here of the difficulties arising from an insidious climate or the occasional hostility of natives, which, though not insuperable, have nevertheless much retarded scientific research in many parts, especially the west coast of Madagascar; but communication is almost lacking and the geography of Madagascar has hitherto been the most imperfect of any country in the world of similar dimensions and importance. The earliest maps of Madagascar are ludicrous in the extreme, and the contour of the island has been gradually determined by marine observations, while the interior geographical exploration, as long as the island was under native rule, was left to missionary travels or occasional naturalists and private scientific explorers, who often fell victims to the climate or to the cupidity of the natives, who robbed and stripped them of their instruments and sometimes took their lives. In any case, meritorious as was their work, it was disconnected and imperfect as a whole and consisted merely of a broad network of routes through the island, with little or no knowledge of what lay between them. Moreover, as is explained later on, it is impossible in such a mountainous country to obtain a survey merely by traversing the island with the aid of the compass. Nothing but a trigonometrical survey of such a vast territory could satisfactorily attain that object, and this, to be effectual, must naturally have had to be under one supreme control, embracing the whole island. It is gratifying to see that, whatever be the qualities of the French for colonization, they have taken in hand seriously this work, and Madagascar is likely to be shortly known to the scientific world under many new aspects. In order to draw your readers' attention to this undoubted advance in the path of science I have culled from the latest reports of the sittings of the Academy of Science in Paris such remarks and data as I think will be new to American readers, with some references to the latest works and cartographical productions relating to the island of Madagascar from a geographical point of view.

ON THE GEOGRAPHY AND CARTOGRAPHY OF MADAGASCAR AS DEVELOPED BETWEEN 1897 AND 1899.—General Gallieni, who is now in France after having exercised for two years and eight months the distinguished functions of Governor General of Madagascar, was not merely occupied in pacifying and organizing this new colony, which he found in a complete state of anarchy and rebellion, and where in a very short time by his firm and intelligent administration he arrived at really extraordinary results. It is known to all the world that at the outset of his brilliant career he was one of the first explorers of the Western Soudan, and that his long stay at Segou-Sikoro was as valuable to geography and ethnography as to the expansion of French influence. More than ever convinced after his long campaigns in the French colonies in Asia and Africa that science alone can advantageously open the way to colonial enterprise, as soon as he arrived in Madagascar he immediately organized a methodical and systematic exploration of the different provinces, so as to make us acquainted with them from all points of view, and to furnish us as completely and as quickly as possible with the details of their resources.

Consequently, his first efforts were directed to the issuing of a map of Madagascar, which in 1896 was scarcely in embryo. An exact, correct and detailed map is, in fact, the indispensable basis of any serious study of a country, as well as of all scientific research and exploration.

Before the conquest of the island by the French the central province had been triangulated and drawn with care, but the rest of the country had only been crossed by a few travellers, whose want of exactitude left much to be desired, and whose routes even then circumscribed enormous tracks of unexplored territory. On the 1st of November, 1896, the General reorganized on a new basis, with the aid of his Chief-of-Staff Lieut.-Colonel Gérard, the geographical service of Madagascar, which had been established at Tananarivo a few months previously, and which has become one of the offices of the staff under the title of Topographical Office. This office is intrusted at the same time with the triangulation of the great island and with a definite map, as well as with the production of photographs, engravings or lithographs likely to be serviceable for a better acquaintance with the colony under its different ethnographical aspects, its botanical resources, and its agricultural and mining prospects. It has been under the able direction for two years of Captain Mérienne-Lucas of the Infantry Marine, who has drawn up a considerable number of maps, which have been forwarded to the French Institute.*

A manuscript memorandum of 40 folio pages, accompanied by a map, scale $\frac{1}{1000000}$, also in manuscript, giving the actual state of the triangulation of the first degree of Madagascar, as well as plates containing the geographical co-ordinates of all triangles measured by the Reverend Fathers Roblet and Colin and the geodetic officers, both of which have been forwarded to the library of the French Institute, contains most valuable and interesting information on the work hitherto carried out and the results obtained.

The following will give some idea of the plan of the work:

The system of projection adopted for the production of the map is the same as that employed by the War Office, that is to say, Flamsteed's projection, modified by Colonel Bonne, which admirably suits the island of Madagascar on account of its elongated form in the same line as the meridian. The development is effected on the 47th degree East longitude and the 21st degree of South latitude—these two axes passing pretty nearly through the centre of the island. Contrary to the case with maps of France, the concavity of the meridians and parallels of longitude and latitude is naturally turned towards the South Pole. The scales on which the sections of the map are drawn up differ according to the value and number of documents in the hands of the Topographical Office: for the central and eastern regions and for Diego Suarez the scale is $\frac{1}{100000}$, but for the rest of the island, as yet little known, we have to be content with a contemporary map on a scale of $\frac{1}{300000}$, which comprises 32 sheets of 35 x 33 centimetres, while the map on a scale of $\frac{1}{100000}$ will entail 508 sheets, each representing a surface of 48 x 30 kilometres, or about 560 square miles.

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* Twelve sheets of the map, scale $\frac{1}{100000}$ (Tiakoderaina, Anjozorobe, Ambohidrabiby, Analabe, Lake Itasy, Antananarivo, Moramanga, Soavinandriana, Ramainandro, Andramasina, Beparasy); three sheets of the map, scale $\frac{1}{500000}$ (Ankavandra, Morondava, Soavinandriana); and one general map of Madagascar, scale $\frac{1}{2500000}$.

In a country like Madagascar, where by reason of the geological formation of the soil, the incessant variations of the angle of de clension in points quite near in latitude, where even sometimes in the same spot they reach 4 degrees, the working of the plans and itineraries by means of the compass carried on by some of the explorers for the construction of the map became a sheer impossibility, it was indispensably necessary to complete and rectify by a thorough triangulation the series of co-ordinates hitherto known.

During the march of the French army in 1895 Captains Bourgeois and Peyrouel had connected Majunga with Andriba. From 1897 geodetic chains were extended following the two axes of the island, and the telegraph line from Tamatave to Antananarivo and thence to Majunga gave the opportunity of exactly determining the longitudes and placing the astronomical points.

During the same year the Reverend Father Colin extended the triangulation of Imerina as far as Andriba, and continued it to the east to join with the work being carried on by the topographical brigades between Ambatondrazaka, Tamatave and Andovoranto, which took for a basis a line parallel to the sea, which was measured three times by two different groups of observers, near Ankarefo, with a steel tape. These three measurements gave the following differences over and above the mean length of 5082.13 metres: the first measurement $+0.^{m}26$; the second measurement $-0.^{m}25$; the third measurement $+0.^{m}08$.

In 1898 the network was pushed on from Ambatondrazaka to Antananarivo; the side Antananarivo-Lohavohitra, calculated on the base line of Ankarefo, has a length of 41,312 metres, and by the base line of Ialamalaza 41,311 metres, that is to say, a difference of about one yard, which is very satisfactory.

The Reverend Father Colin in 1898 explored the west, and corrected a great many astronomical positions.

As to the topographical brigades, they have thrown a network of triangles along the south, following the long axis of Madagascar, from Fianarantsoa to Fort Dauphin, with a transverse axis running northeast and southwest from Ihosy to Tulléar. This section of the triangulation is effected on two base lines, the one temporary, measured near Fort Dauphin, the other 9,537.71 metres long, measured in the Horombe district, where the necessary observations of latitude and of the azimuth have been taken. The values of the logarithms on the Antananarivo-Lohavohitra side, calculated on the length of the Horombe base and the chain south of Antananarivo, are identical to the sixth decimal point with the results arrived at by starting from the Ankarefo base. At Fort

Dauphin verification is effected up to four decimal points with the logarithms of the temporary base.

During the year 1899 the programme laid down for the geodetical brigades consisted in connecting the district of Ambatondrazaka with Diego Suarez. There is also the question of completing the triangulation, started in 1892 by the Revd. Father Colin, between Antananarivo and Andovoranto, and elucidating the question of the touch with Andriba by the triangulations of the Rev. Father Colin and the expeditionary corps of 1895, which show a discrepancy of 12 miles of longitude.

The skeleton work of the triangulation of Madagascar is therefore shortly about to be completed on these broad lines. The perseverance and skill displayed by the officers intrusted by General Gallieni with this important and difficult work have been crowned with success. In less than three years they have measured a chain of triangles, the development of which covers 850 miles and upwards. It must be said that this work was first commenced scientifically by the Jesuit Fathers Roblet and Colin; but great credit is due to General Gallieni's staff, particularly to Captains Gros, Durand, Dumézil, Lallemand, Maire, Vallet-Prévost, Hellot, and to Lieut. Maritz.

We may hope, then, shortly to be provided with a complete map of Madagascar, which hitherto has undoubtedly been the most backward country in the world for the accuracy of its cartography.

The latest corrections made to the former co-ordinates of some of the principal points in Madagascar cause a very notable change in the outline of the southeast and west coasts of Madagascar. I append the principal ones, with the differences between the old and new.

POINTS.	LATITUDE S.	LONGITUDE E.	DIFFERENCES	
			LATITUDE.	LONGITUDE.
Tamatave (R. C. church tower)	18° 9′ 28″.4	47° 3′ 39″.1	−0′ 7″.5	− 1′ 35″.9
Andovoranto (northwest angle gov't house)	18° 57′ 32″	46° 44′ 29″.6	−0′ 28″	− 2′ 46″
Fort Dauphin	25° 1′ 51″.6	44° 38′ 26″.2	−0′ 3″.7	−11′ 19″.5
Mevatanana (flag-staff)		44° 27′ 49″		− 3′ 11″
Majunga	15° 43′ 24″.2	43° 56′ 36″		− 1′ 59″
Tamboharano	17° 30′ 3″	41° 47′ 46″		+11′ 31″
Maintirano	18° 9′ 54″	41° 42′ 45″	+0′ 44″	− 0′ 5″
Benjavilo	18° 59′ 57″	41° 53′ 0″	−3′ 48″	− 0′ 55″
Tsimandrafoza	19° 47′ 30″	42° 4′ 30″	−0′ 10″	− 3′ 45″
Morondava	20° 17′ 21″	41° 56′ 45″	−0′ 54″	+ 0′ 30″

NOTE.—The longitude is calculated from the meridian of Paris.

While the officers of the Geodetic Department have been pursuing their labors of triangulation, into which I have attempted to give an insight, others have made a topographical plan, on the one part of the region between Tamatave and Ambatondrazaka, and on the other between Tamatave and Andovoranto. The topographical office has now collected and condensed the numerous plates of Father Roblet, and has completed them by the aid of the discoveries of Lieutenants Rocheron and Cointet in the district of Ankavandra; of Lieut. Maritz between Andriba and Vohilena, and between the rivers Ikopa, Betsiboka and Mahajamba, and to the west of Betafo. Others have perfected plans, not only of the east and north of Antananarivo, but also of the Sakalava country, and documents are now forthcoming to permit of the publication of a serious map of these regions on the scale of $\frac{1}{500000}$.

Scientific missions connected with the army of occupation have, moreover, overrun the country in all directions. I might specially mention those from Antananarivo to Diego Suarez, and from Tsaratanana to Nossi-Bé, and the Mangotsy river, which have been rich in results of all kinds—geographical, ethnological, meteorological, zoological, botanical, geological and agricultural.

These results are condensed in a very useful and instructive monthly publication printed in Antananarivo, entitled "*Notes, Reconnaissances et Explorations*," two volumes of which appeared in 1897 and two in 1898. These volumes contain no less than 1,600 pages and 100 maps or plans made in Madagascar, and I recommend them to your readers for the most scientific treatise on the present geographical development of Madagascar.

The Immigrant's Guide to Madagascar (*Guide de l'immigrant à Madagascar*), 3 vols. in 8, with atlas and 24 maps, gives a very detailed description of the island under every heading: history, geography, organization, industry, commerce, agriculture, colonization, etc., and shows how much has been done during the last two years.

THE HEATHS AND HOLLOWS OF HOLLAND.

BY

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Holland is often compared to a ship, and all English-speaking people of culture are familiar with the satiric verses of Andrew Marvell, in which this idea is suggested and elaborated. The country draws many feet of water, and one goes on board of it and down in the hold to get at its cargo. As the original ship had no deck, but was first hollowed out, and then, as its evolution proceeded, was built of various parts riveted or nailed together, with floors and compartments, with powers of offence and defence, until we behold to-day the ocean liner and the battleship, so in the growth of the Dutchman's land we trace an evolution almost as wonderful.

This shall be our story this evening: to show by history and geography what kind of a country Queen Wilhelmina's kingdom is —like a ship amphibious, partly in and out of the flood, both dry and wet, surrounded by waters, yet not an island. We shall find that in the midst of the liquid element nature laid something like a keel of hard land, and that by and by man put on the ribs and planks, nailing them together into habitable hollows, yet affording inclosure from the waters and making even a cozy home. In time decks and compartments, with floors and varying levels, were added. Then, when pumps and windmills were erected to keep the hold dry, it looked as though the ship was equipped with masts and sails. When defence was necessary against their ever active enemies, the floods and storms and currents, we see men making their walls thicker, riveting them with piles and buttressing them with piers, jetties and ripraps. Still further, as the nautical man must not only keep his timbers free from barnacles, but also guard against the teredo, or tiny worm, that would honeycomb their substance, so the Netherlanders had to sheathe their land with masses of stone that have almost cost their weight in copper. With new and added dangers from without, the science of defence developed also. The land was armored, and with new possibilities of resistance maintained its life in a higher organization. So today we see the miracle of geography—a hollow land in which, as in a ship, the chief wealth of the country is stored down below the level of the sea, while the windmills and lofty church spires that dominate the landscape complete the wonder. Hence we are not surprised in this country, so nautically constructed and built up, foot by foot and yard by yard, to be saluted with the question as a morning salutation, "How do you sail?"

Furthermore, as vigilance is the first virtue and discipline the prime necessity on board a ship, so here we find these maintained in the Netherlands at a high standard. Other nations have but one state—the political structure and sovereignty, but the Netherlands have two states—politics and water. Yet this duarchy is not, as in the case of old Japan and Siam, personal. There is no Mikado and Shōgun, but the Sovereign State and the Water State. Of the former, democratic monarchy as it is, Queen Wilhelmina is the lovely figure-head. In the latter is comprised the general staff of inspectors, engineers, watchmen and commissaries who superintend the great army of toll collectors, sluice, bridge, gate keepers and workmen skilful with the spades, drills, pumps, piles and the machinery driven by steam and wind. This department, which has charge of the preservation of the country from liquid danger, is the chief division in the Ministry of the Water State, Trade, and Commerce.

Or, if we change the figure descriptive of the evolution of the Netherlands as a growth under human direction, we may say that man by his industry, courage, tenacity and faith has transformed a mud-hole into a garden. Indeed, the Dutch in their proverbs rather seem to intimate that God Almighty had only a subordinate part in the making of their country, and that all the glory belongs to man himself. It is thus asserted, with more wit, rhetoric or poetical fervor than with truth (as in the dictum, "God made the sea, but we made the land"), that the Netherlands have been wholly created through human genius and industry; but this, as geologists and engineers know fully, is not true. We must allow nature and the Power that wears physical laws and matter as a garment some credit for the creation of Holland, and in outlining the story we shall look first to times before the advent of man.

Geologists tell us that the western part of the Netherlands was once an inland sea. The English Channel was not then, as now, open, but closed. The inflowing rivers, Scheldt, Maas, Rhine, Ems, Weser, Elbe, brought down from the interior of the continent strata upon strata of gravel and matter in suspension, laying deposits in the shallow basin. It is possible to trace the boundary of this sea, and even learn its depth, by noting the lines of fossil shells. These are found fifteen to twenty feet deep below the level of the ordinary high tide. This sea bottom was deposited upon older diluvial or drift beds. Three distinct æons are noted by the geologist, but that process most interesting and important for Holland's future history was the deposit of the fertile "sea clay" making the three maritime provinces of Zealand and the two Hollands. When the limestone rock which once united Calais and Dover at last gave way, this life-giving substance was still more abundantly deposited over the sandy bottoms. It is this sea clay, as it is called, which makes the soil of Zealand perhaps the richest in all Europe and which gives Zealand and the two Hollands their preponderant agricultural wealth above the other eight provinces.

To-day, looking at the map, we find the fruits of the endless war of wind and wave in the sand dunes. The crescent of islands northward from Friesland and Groningen are the remains of old lines of dunes. Those lining the coast are the bulwarks of the country. Behind these dunes and the gaps or embrasures in them, now closed by dykes, we find low meadows rich in sea clay, and, further back, heaths, sand hills and diluvial strata which are sufficiently above the level of the sea to remain dry. The dunes, though high enough sometimes to be called hills (the average altitude being sixty feet, some rising even to two hundred feet), do not by any means suggest the Rock of Ages or the everlasting hills, or that immovableness which we associate with elevations in nature. On the contrary, the dunes are but heaps of unstable material and have a tendency to move eastward or to drift off on the landward side. This arises partly from the tremendous velocity of the channel current and partly from the strong west winds. At one place, Loosduinen, the old moor or fenland which once formed behind the dunes, can now be found outside of them, overlaid and packed in the sand. The most remarkable proof of the march of the dunes eastward is in the Roman camp at Brittenburg, or Huis te Britten, west of Leyden, which was built in the early Christian centuries inside the dunes. When the Roman legions departed southward, the camp was overwhelmed by hills of sand. After a thousand years of burial it emerged to resurrection, yet was not visible on land but in the water. In 1694 its lines were discerned sixteen hundred paces out to sea. Relatively this fine ruin has been traveling ever since, while the dunes still tumble inward. Furthermore, Katwijk, Domberg, Scheveningen, Egmond and other sea-coast villages have been frequently removed further inland. In our days the Dutch assist in the making of new dunes, carrying by ship or rail vast quantities of the sand from these wind-formed hills for defences in other places against the seas. Netherland is a country whose soil can never be still, but must ever be kneaded and rearranged; yet not a shovelful is wasted, for it cannot be spared.

To-day the Netherlands are protected by nearly sixteen hundred miles of sea dikes and a still larger number of miles of river dikes. Ninety lakes have been drained. By dikes and pumps the Dutch more than doubled the original area of their country as first known in historic times, and they support a population nearly eight times as great as when they first took up arms against Philip of Spain for independence. Their political history, glorious as we read it in the prose epic of Motley, and honorable, in that Holland has been the teacher of nations and the benefactor of the world, has for its most shining chapter that of rescue and defence from water of the richest little country on earth and the demonstration of man's lordship over the elements. To appreciate the achievement, let us glance at it chronologically.

When man first appears upon the scene he was a hunter or fisherman who lived on the German slope, the dunes, or the higher ground deposited in time of flood. A few feet or inches below him were the fenlands, rich in undergrowth and populous with animal life in fin, feather and fur, amid which rose great forests where were numberless pools and lakes. In the sea clay land were here and there dry spaces upon which his tamed animals could graze, and during dry seasons he could take his cattle and pasture them there. By and by, as he became more venturesome and learned how fertile were these beds of sea clay, he cultivated the soil and stored up food for winter. He brought clay from the space around his hut, gradually elevating its foundations a few feet above the surrounding waters, in time making his mound habitable even in time of flood. As men associated together in enterprise and labor, there appeared upon the landscape the *terpen*, or artificial mounds of larger size, which the traveller notes on the landscape of Friesland, Groningen and Zealand. These, in the evolution of history, became the bases of towns and villages, the Groote Kerk standing in the middle. Or, the original *terp*, if unbuilt upon, was made the burg or fortress, as in Leyden. Linguistically the word is related to *dorp* or *dorf*, meaning village. To-day the archæologist finds in excavating these terpen a number of strata representing the various eras of civilization. At the top are the modern buttons, bits of crockery and wastage of picnic parties. Further below, the rake or spade gathers up mediæval images, coins, crosses and relics.

Still further down are the tools, jewelry and personal possessions of the mediæval Frisians, Angles, Saxons and other tribes. Next in revelation are the images of Mars and Venus and things of Roman use and ornament, of war and of peace. Last of all we find the stone combs and bone needles of primitive man. Modern science also shows these terpen to be rich in animal deposits, and, being composed of these and the prized sea clay, the substance of terpen when cut down and carted away is sold for so much a ton as a rich top dressing for sandy land, yielding in some cases a small fortune to the owner.

Further back from the sea clay lands of the coast and sloping upward toward Germany are the sand hills; and in North Brabant, Guelderland, Overijssel and Drenthe are vast heaths of this infertile substance. Large parts of North Brabant have only stains or patches of vegetation, with not a little morass, the fertile portions in the sea deserts being oases of clay soil. Every one knows of Batavia and the Batavians, whose name comes from the Betuwe, that is, the better or the good land or island, well watered, rich in river alluvium and sea clay and known from the dawn of history to be fertile. North of the Betuwe, in Guelderland, is a great Veluwe or vile land, a perfect wilderness of sand, which it is hopeless to try to cultivate or fertilize. This barren "island," stretching between Arnheim and Zwolle, the Rhine and the Zuyder Zee, is traversed from east to west by a railway, and right in the western centre is Het Loo, the palace of Dutch royalty. Similar sterile plains, or rolling land, unstable as water, and never excelling, are found in Overijssel, while Drenthe is nearly all sand. Yet, at Coevorden, which means Oxford or Bosporus, between the two areas of sterility and hopelessness—that is, hopeless to anybody but a Dutchman, for he is now busy in draining and reclaiming them—the great Bourtanger morass and the Drenthe barrens, a strip of hard ground forms the gateway into and from Germany. In Roman and in all other times, since "geography is half of war," Coevorden has been a defensive frontier fortress; while again, to illustrate the truth that, in these Low Countries, sand is death and clay is life, only a few miles away from Coevorden are the green fields of Dalen, with their pretty houses and sleek cattle. And this because here is a dot of clay soil.

It is in Drenthe, perhaps contemporaneous with the terpen, that we find the first structures raised by men, who may have been the Cimbrian Celts. With their rude levers and rollers they gathered together into semblance of order the boulders brought down by

Scandinavian glaciers in the Ice Age, rearing edifices which whether they are tombs or altars the learned are not yet agreed. Tradition, as rich as moss on the unrolling stone, names these Hunebedden or giants' graves. On the soil of Drenthe there are about sixty of these groups of boulders, the most striking being at Rolde and Zuidlaren.

While the five maritime provinces of the Low Countries illustrate the hollows, the six inland provinces illustrate the heaths. To the artist and to the lover of the picturesque in nature the charms of the heaths are as great as are the hollows to the engineer and student of civilization. The wild flowers that win their life where there is moisture, the inconspicuous blooms and the lower types of vegetable life in the peat beds and turf, furnish marvellous effects in color and beauty. At sunrise and sunset, especially when the prismatic tints of the dew pierced by the sun's rays add their reinforcement of color, there seems to be a gloss of glory that makes these heaths like the Field of the Cloth of Gold. In the marked alterations of tint and hue caused by slanting sun rays and varying measures of sunlight there are effects which are to the eye what sweet music is to the ear. I can testify to many pleasant hours spent in these solitudes. Certain it is that artists from all parts of Europe come hither to feast their vision and take delight in these lonely places.

When the first light of history falls upon heath and hollow in the Low Countries, we find that the rude engineering of the people whom the Romans found in the land has been supplemented by the work of masterful men, who needed camps and military roads and improved water communication to hold the people whom they had conquered true to their allegiance. Their works, with spade, hammer and trowel, are mostly associated in local tradition with Drusus and Corbulo, but no one can say exactly where the grachts or canals cut by them are now located. Not a few places in the Netherlands bear names that are but modifications of the original Latin, or Latinized Keltic or Teutonic words, such as Vianen, or Fanum Dianae, Nymegen or Novio Magnum, Doesburg or Drusus Burg, Leyden or Lugdunum, etc. Other things borrowed from the Romans, either during their occupation or later, are seen in the terminations or the words meaning canal, street, port or gate, wijk (from vicus), etc.

During five centuries, the Frisian terp, the Teutonic mark and the Roman farm, camp or villa adjoined. While with temples and altars there were towers, fortifications, camps, roads and canals, yet the Netherlands resembled for the most part a frontier region, the lowest and the most watery in the Empire. Whatever the Roman's impress may have been upon the landscape, his works were not only given to neglect or destruction by the overstreaming of the nations from the North and West, but were overwhelmed with the wind-driven sand or the overflowing sea and river. This new top dressing of humanity under Christianity brought in the Middle Ages, or that period between the Roman engineering and civilization and the rise of brickmaking and the building of dikes and dams.

From the sixth to the eleventh century very little was done to change the general surface of the land, though much improvement was secured in favored places. It is interesting to glance at a mediæval map in order to see how great have been the triumphs of man, the lord of the soil, in the seventeenth and especially in our own century. Walcheren in Zealand, now a single island, was once a dozen islets. Much of what is now South Holland was under water, and in what is now the province of North Holland, where are to-day shining green fields rich in cattle, was a network of pools, lakes and broad, sluggish streams and lagoons. Zealand had more islands in it than it has to-day. It is further interesting to note where were the towns, villages and churches, showing that here, at least, were the points of hard lands where human beings could live socially together. We may imagine the whole country as a great flat delta formed by the deposits of the continental rivers. For the most part, certainly along the coast and in the southern river district, were hollows or bowls filled with water, both salt and fresh, with here and there little islands standing out on which were towns and villages. On the western side, toward Germany, were great sandy deserts, and vast, gloomy morasses. Between the two sections of heath and as yet undrained hollows spread the Lake Flevo, of Roman name. All the rivers, or streams with currents, flowed from east to west, except one which joined the waters of the Rhine to those of Ijssel. All the time the shape of the country was being altered by the ceaseless action of the water, in storm and flood, wind and current, rain and tide. In the thirteenth century, by a great influx of the sea, eastern and western Friesland were separated and the Zuider Zee was formed, making secular differences in manners, customs and language. To-day, after six centuries, the Dutch have decided to drain the land and drive out the intruder. The twentieth century will see the work done.

With the new movements of society, caused largely by the Crusades, with the stimulus to intellect, inventions, manufactures and commerce given by the meeting of nations and contact with the rich East, we find toward the twelfth century serious efforts made to keep out the waters of sea and river, to extend the area of arable and pasture land—in a word, a beginning towards the making of the country as it is to-day. The introduction of the windmill was a powerful factor in attaining this through the saving of human labor. From being a rigid and immovable structure, always facing one way, it has been so modified by the Hollanders that by means of a movable cap and windlass the sails may be set to face any wind, and the sails on the spars or arms may be furled or spread at pleasure. The windmill is now of manifold assistance to men, for it can pump, grind, hoist, lower, work the screw or the scoop wheel and serve as storehouse or dwelling.

The building of barriers against the sea began in earnest after the twelfth century. For the first time we note upon the map the names of places ending in "dam" and later those ending in the name dike. There is a distinction, with something like a real difference, between the two terms. The dam is usually the protection of one farm, village, castle or town; it may be circular or square, an enclosure of some sort. A dike is a dam, but it is longer, and often stretches from one town to another, or it fills the whole gap between the separate dunes or encloses a whole island or many islets, making one unit of hard land. Again, it is the backbone of a whole district of country. So also between "gracht" and "canal" we discriminate. We find a gracht a moat, a private or municipal ditch. A canal is a waterway, a national or provincial highroad, connecting cities of sea and river, and usually many leagues long.

By the fifteenth century it was borne upon the minds of the Dutch people, stimulated by good rulers, the idea that their country might be greatly enlarged and enriched by unity of effort. To use their own mottos, "Eendracht maagt macht," unity makes strength, and "Concordiā parvæ res magnæ crescunt," by concord little things become great. They have not yet reached the determination to reclaim land on a large scale, or come to the making of polders by pumping, but there are being invented the tools which are to do the work. Well says Marvell:

> "Among the blind the one-eyed blinkard reigns,
> So rules among the drowned he that drains;
> To make a bank was a great plot of state,
> Invent a shovel, and be a magistrate."

Either by original invention, or by adoption and adaptation, we behold in the Netherlands above every land in Europe rapid evolution of brick and tile making, the plough, pile driver, pump, windmill, drill, stove, dredge, mud scow, submarine mattress, canal locks, and ship's camel, with new methods of diking and general improvement in hydraulic and hydrostatic science. The distinction is made between the outer waters of sea and rivers and the inner waters caused by rainfall, especially in the peat pits. The unstable land is riveted together by piles, and whole forests are imported and planted head downward, the people living on top of timber that was once nearest to the roots. In Dutch architecture the piles are as the men, giving solidity; the superstructure as the woman, making grace and beauty. But if the houses are to their piles underneath what wives are to their husbands, they thrive or suffer according as the former are steady and keep their position or sway and lose equilibrium. Do women lose grace and charm according as their supports are deranged? So do the Dutch houses. They have to be held together with rods and shores, or laced with braces and anchors, so that we often see in old Dutch houses what suggests stays or corset, or an iron frame such as we now build of steel inside houses, before putting on the outward clothing of brick or stone. Think of the mighty forests buried head downward in the soil of Holland, the billions of trees and poles driven in to pin and hold things together! Sometimes it costs more, not to lay but to drive a foundation, than to build a house, more for the under than the superstructure. As a rule, cellars are not known in maritime Holland, though basements, with their tiled walls and well-cemented floors, are common.

In the work of defending the country with dikes, the monasteries often took part at first, paying the expenses or eking out funds secured by taxes. The stadholders or king's lieutenants often made noble names for themselves in rousing public spirit to wall with turf and timber the hollow land against storms and floods. About the sixteenth century began also the building of jetties to strengthen the dikes in resisting the ocean. It was probably not, however, until the seventeenth century that the work of draining the lakes and wresting land from the sea by means of dikes and pumping was seriously or systematically undertaken. In North Holland, however, with funds provided by stock companies, led by Usselincx, that made their money by selling off the land recovered to cultivation, or by utilizing the booty fished up by Dutch divers from the Spanish ships, the work of making large polders was inaugurated on a large scale and has continued during three centuries. Where was once lake and morass we have now farms, villages and towns, and cows feed where the fishes once did. So rapidly in some cases was the work done that the town arms represent the mermaids as being surprised and put to great inconvenience by the sudden change in their element. Waking up from their naps, they vainly try to get out to sea through the sluice gates. To-day the great Beemster polders create, in discerning tourists, the highest admiration.

The cutting of canals and means of communication between town and city, facilitating inland commerce, went on apace, while the digging of turf for fuel became a national industry. The riches brought to the Netherlands by foreign commerce were utilized to reclaim and enrich the native land of the explorers, whose flags were mirrored on every sea of the world. Yet, while the ships from the Orient brought back spices and gold, and many rare and precious treasures, they also imported one execrated though tiny immigrant, and for awhile the boldest people in Europe felt like a lion with a gnat stinging his nostril. This enemy, no bigger than a pin-head when it begins business and earns a living for itself, caused as great a revolution in the making of dikes and dams as gunpowder had caused in the equipment of the soldier. Yet, whereas the steel-clad knight had perforce to doff his panoply and be content with cloth, the Dutchman had to change his dikes from wood to stone. The new and dreaded intruder was the teredo, a tiny worm which needs only the space of a pin-head for its days of babyhood, but which soon grows to be inches in length, and for activity and effectiveness can give points of profit to the steam rock drill and diamond perforator. The little creature bears no malice to man, but, in search of his food only, he perforates and cuts long tunnels in the hardest wood, quickly honeycombing and destroying keel, stanchions, ribs and planks. Using the salt water as a lubricant, he works his stony head like a universal ball joint-bearing file, drills and reamers and renders useless the toughest defences which the forest can furnish. The solid beams and piles set for the defence of the Low Countries, bolted together as they were with iron, were found to be eaten through and through. When the Dutch people discovered this state of affairs along the coast they were more frightened than when the hosts of Alva or Louis XIV. invaded their soil and beleaguered their cities. So after fasting and prayer before God they rose up to work. Whereas the old material for the making of dikes was of earth and turf faced with wood or osier work, and only occasionally of brick, especially in the city canals, it was now necessary to seek in Scandinavia and Germany for a new suit of armor. They imported whole fleet-loads of Norway stone, basalt and granite, with limestone from Belgium and many varieties of teredo-proof rock from Germany. They also learned to improve the form of the dikes, so sloping them at the correct angle that the force of the waves was broken upon the bed of water itself. This is done, not by opposing a perpendicular face or wall against the billows, but by laying down, far out on the sea bottom, mattresses of osier work filled with rubble or beds of tough clay, on which slope the stone is rammed, making an inclined plane, on which the waves are made to waste their force and thus destroy themselves before reaching the top of the dike. Improving their pile drivers and other tools, the Dutch became exceedingly skillful in the work called zinkstuken, that is, in the making of large mattresses of wattle work and timber that would float until loaded with turf and stones, and then, at the right moment and in exactly the right place, be sunk under the waters to form the bedding upon which the stonework could rest. So soft and treacherous is the sandy bottom that unless piles in great numbers are driven very deep it is not worth while to heap up heavy masses of stone, and the better way is to make a bed of clay or mattress work and rest the basalt columns or pieces upon this. In some places, however, where the water is very deep, ripraps are made by sinking granite blocks pell mell, to protect the ends of the jetties which are placed at right angles to the shore line to strengthen the dikes. These jetties are from one hundred to three hundred feet apart and are sometimes nearly five hundred feet long, besides having sixty or eighty feet of ripraps at the sea end. In front of the famous Petten and Hondsbossche dikes at North Holland we find these outriggers of stone six and seven hundred feet long tipped with eighty feet of riprap work.

With such a variety of level in the country, and with so many heaths and hollows, it is necessary to have some standard level. This is found at the chief city, and is called the Amsterdam pijl, zero, or level, or is usually written or spoken of as the A. P. On the maps of the country made by the Water State, we have the levels of various farms, polders and watercourses expressed in metres or fractions thereof, according to the height above or the depth below A. P. The whole water system is also utilized for national defence, for in case of armed invasion by enemies it is possible to flood large portions of the richest provinces of the kingdom. What has been done in the days of William the Silent and William III. against Alva and Louis XIV. can be done again, if necessary, in the days of Wilhelmina. That the Dutchmen are quite ready to do it may be illustrated, at least, from an incident which took place shortly after the Franco-Prussian war. When some German newspaper intimated in a cartoon that, unless the Dutch Government did so and so, the Uhlans would be seen as the picture showed, riding down the streets of the Hague, the next week a Dutch newspaper came out with a cartoon, without one word of text or explanation, showing the Uhlans with four inches of water above the tip of their helmet spikes.

Yet, despite all the wonderful things that a Dutchman can do, he cannot make the wind blow when Boreas is not in the mood for work. It has been shown that in each year there are only 130 full days of twenty-four hours which have sufficiently strong winds for working the mills, and although the windmill is still useful and to it the Dutchman must ever have a feeling of gratitude as one of the makers of his country, yet its day is over. Few new windmills are built either in brick or timber. The steam pumps have taken the place of the windmills, and many portions of the Netherlands that were once malarious are now drained and kept dry by them. Indeed it is because the Dutchmen have been helped by steam that their record of drainage and reclamation of land has been so wonderful during this nineteenth century. From 1833 to 1877, the increase was from 8.768 to 12.731 square miles of area. In the days of the Pilgrim Fathers, Haarlem Lake, covering 45,000 acres, was a large body of water with room for fleets to manœuvre in, and over which their boats floated to Leyden. This body of water, typical on account of its size and shallowness, not only covered much valuable sea-clay land, toward which the Dutchman always casts a jealous eye, but in time of storm was exceedingly dangerous to the towns and cities on its banks. The violent wind, blowing long, would drive the waters beyond their bounds, flood the farm lands and menace Amsterdam and Leyden. So it was determined to throttle the dragon,drive out his mermaids, and actualize the dream of Leighwater, dreamed two centuries before, who needed 168 windmills for the work. Three great steam engines, named after famous Dutch engineers, pumping night and day during four years, from 1848 to 1852, lifted 800,000,000 tons of water into the sea, and the lake disappeared. Villages, farms, gardens, fruitful fields, flower beds and hedges, are now on the solid lake bottom. Within the 41,675 acres won to cultivation are 130 miles of roads and canals, 70 bridges, and about 12,000 people. The precious sea clay, making the best bulb land in the world, returns a larger annual revenue to its owners than almost any other part of the kingdom. Other lakes were drained and vast polders regained to agriculture, making the record of the nineteenth century very wonderful. The polders made from the Y River cover 12,540 acres.

The work of keeping the proper equilibrium between the outer and the inner waters of the country is one that admits of no relaxation of energy or vigilance for a single moment, and the details of dike building, and of canal and ditch cutting for the proper outlet and supply of the waters are of fascinating interest. It actually comes to pass in some dry seasons, when "the river of heaven which is full of water" withholds its supply from the skies, that the direction of the pump screws has to be reversed and fresh water has to be lifted from the rivers to give vegetable and animal life its proper supply. Oftener, however, the skies weep too copiously, and how to wipe off the celestial tears from the landscape is the Dutchman's problem. Infiltration is another frequent cause of danger to his farm.

Such being the history of man's conflict with the water, which furnish him his problems, conflicts and friendships, his help and his harm, it is not wonderful that the story of struggle and triumph, victory and defeat, is mirrored not only in the language and proverbs, but also the art and graphic symbols of the country, and in the habitual action of the minds of the men who lived in this hollow land. The people are like their dwelling place. History has demonstrated that it is not wise for arbitrary rulers to trifle with the people who have been for a thousand years fighting the waters, and liable to be drowned day and night, unless ceaselessly vigilant and prepared for danger. The everyday talk of Mynheer bristles with references to dikes and dams, windmills and polders, bridges and canals, and well-flavored with the salt of wit that reflects the natural environment is the written and the spoken language. In proverbial speech we see "the sheep over the dam," and it is beyond the dike or the bridge that the little Dutch Bo-peep must go to find them. The untested courage of the dog is always greatest and his bark "loudest on his own dam." In Holland the proverbial obstacle in the way is not a wall nor a lion, but a dam. Does a man do his work well? Then it is said that "he has laid a good dam." In parenthesis, we remark that this word dam—spelled without an *n*—has no suggestion of profanity to a Dutchman's ear. Thus a great deal of English fun and many American jokes lose their point and flatten on his tympanum, for he pronounces the word with a long *a* as in father, *i. e.*, Amsterdam, Dubledam. Instead of the nüllity which "butters no parsnips," or the tool that "cuts no ice," in

Holland it is that which "brings no sods to the dike." "Who will not dike must retreat before the waters." The "hustler" is a "diker." Men with an unusually good appetite are "polder jongen" or polder boys, and such a man "eats like a diker." The well-to-do farmer has "his sheep on the polder," or "he sits on a droogje;" that is, a dry place, he has a soft snap, a snug berth. Of one in authority it is said he is "the boss of the polder-gasten," or workmen.

On the Dutch Thanksgiving Day the native may say, "Our land lies in a polder."

Perhaps no country is richer in heraldry, armorial bearings and especially in town arms or the graphic symbols which in themselves often tell the story of local history. It is astonishing how many of these *wapen*, or town arms, have upon them the waves or lines representing water, the fishes that have been displaced or serve for food or revenue, the shells, aquatic birds, mermaids, polders, turf bricks or heaps, or the tools by which the wet land has been made dry or conquered from the sea. In one case the mermaid holds up her hand in surprise and despair because men have won her domain to uninhabitable dryness before she could awake. One polder's blazon is a hand rising from the waves holding a cornucopia. The clover leaf and wheat sheaves are the quarterings upon a shield above the legend meaning, "Out of the waves." While old towns on the heaths and especially on the western dry land glory in the saints and the mitred and crosiered lords spiritual, with all ancient heraldry of lords temporal, of dragon, lion, crowned eagle and other symbolism borrowed from mythology, most of the insignia of the communities in the hollows, or won from the waters, show traces of or reveal clearly their engineering history. Probably the most eloquent of all, which also tells the whole nation's story to eye and ear, is that of Zealand. We see a lion struggling out of the waves and semi-fluid land to be free. His head, fore paws and part of his body show strenuous but progressive activity, yet exertion is still necessary, and underneath is the motto, "Luctor et emergo"— "I struggle but I rise." So has the whole story of this land of heaths and hollows been one of constant toil, but also of victory that sublimely shows how man has conquered nature. Yet while on the surface of jest and badinage the natives may assert that they have made the land they live in, their deepest feelings are expressed in that emblem, long ago chosen to express the faith of the Netherlander, who though he write the motto "Eendracht maagt macht," "Unity makes strength," puts alongside of it, or rather above it, the legend containing his own older, profounder and more enduring sentiment, *Nisi Dominus frustra.*

KOREA'S GEOGRAPHICAL SIGNIFICANCE.

BY

HOMER B. HULBERT, Seoul.

The Peninsula of Korea, forming as it does a stepping stone from the mainland of Asia to the islands of Japan, and forming, together with Japan, an obstruction to the great "Black Stream" which is the Gulf Stream of the Pacific, has not only strategic importance but great ethnological significance.

In order to determine in what this significance consists it will be necessary for us to give a brief outline of the dispersion of the so-called Turanian peoples. This term Turanian is properly and necessarily a vague one, for it covers that portion of mankind who have left so few literary monuments, whose migrations have been so wide and so confusing and whose antiquity is so great that vagueness is an unavoidable quality. Recent study has done something to clear up the mystery, but still this portion of the race remains practically unexploited from the standpoint of the ethnologist. As to the origin of this great family we have nothing but theory, but there are a few large, outstanding facts which afford us at least a clue to a working hypothesis.

In the first place we are sure that the Turanian family antedated the Aryan. It has been satisfactorily proved by Bishop Caldwell and others that the Dravidian people of Southern India are of Turanian origin and were formerly the masters of the Indian peninsula. The advent of the Aryans, with their superior civilization, drove the Turanian inhabitants of India southward into the Deccan, where they survive, unmixed with the purely Hindu population. This Turanian stock, then, while not clearly defined, is confessedly some of the most ancient that can be even approximately placed. But these original inhabitants of India are closely allied, linguistically, to the Mongoloid races of Central and Northern Asia. The philological question has not as yet been exhaustively treated, but enough has been done to prove that there is a strong racial affinity between the agglutinative languages of Southern India and the Mongoloid or Scythian dialects of Northern Asia. It would seem probable that at some immensely remote period, before the Aryan race received its inception or even the Turanian races had taken on distinct form, a primitive race of semi-savages found their way from the Iranian plateau eastward across the lofty mountain barrier that marks the western confines of China and descended into the valleys of the Yangtse and Hoangho Rivers. This must have taken place before the beginning of the pastoral age, while men still lived by the chase, for by no stretch of the imagination can we conceive of their transporting their flocks and herds across those bleak highlands. In physical characteristics they must have been of the Mongoloid type, but it is interesting to note that the so-called characteristics of the Mongol type—namely, the brachycephalic skull, the oblique eye, etc.—are common to the Malay peoples, the Eskimo and many others; so that these peculiarities alone are not enough to determine the Mongoloid origin of the Chinese people. After this emigration had taken place the rise of the pastoral era cut off these original settlers in China from communication with the dwellers to the west of the great mountain barrier and determined once and for all the isolation of China, an isolation that has remained almost unbroken. With the opening of the pastoral era a second and immensely great exodus took place from the original home of the race. This was the true Turanian family, which, apparently splitting at the apex of the Himalaya and Kuenlun mountains, passed south into the Indian peninsula and north into the steppes of Central Asia. This northern branch, again subdividing, passed eastward into the valley of the Amur and westward into Russia. The eastern branch penetrated to the borders of Korea and even occupied certain portions of the northern provinces of that country.

Meanwhile, the southern branch, which had settled in India, was overwhelmed by a subsequent Aryan invasion and driven into the southern mountainous portion of the peninsula or across the Bramaputra river into Burma. The Malays may not unreasonably be supposed to be the result of this great hegira. But the Malay peninsula proved to be only another point of departure. They spread east and north into Oceanica and into that vast series of islands that stretch from Borneo to Bering Sea. The inhabitants of the Philippine Islands are Malays. The wild tribes of Eastern Formosa are Malays, and there is reason to believe that this great wave of emigration did not break until it reached the natural barrier formed by Japan and the peninsula of Korea. The evidence goes to show that two thousand years ago all southern Korea was inhabited by a people distinct from those of the north and practically unknown to them. They were a people of southern origin, as is proved by a conclusive line of reasoning, both philological and general. If this be true, and the early settlers of southern Korea did actually belong to the southern branch of the great Turanian family, then it seems that China was simply encircled by the Turanian race, the two branches meeting about the centre of the Korean peninsula.

The argument in support of this theory is a long and complicated one, and it will be possible here only to indicate the most striking points in it. The powerful kingdom of Chosun, in northern Korea, fell in 193 B.C. Its fugitive king, passing southward by boat, came to the southern coast, where he found a people distinct from those of northern Korea in almost every particular. So startling was this difference that it has been clearly indicated in all the historical records of Korea. This difference was so marked that we may assume that the people of the south were of a different origin from those of the north, or at most only very remotely related. Their customs were in almost every case different from those that prevailed in the north. The names of their towns bear almost unmistakable evidence of their southern origin. The people tatooed, they lived mostly near the shore in little maritime villages. Their traditions pointed southward. Their language when compared with those of southern India shows a marked similarity—so marked that this alone would be almost conclusive evidence. We will notice that the "Black Stream" flows along the eastern coast of Asia in a northerly direction; and this must have had its influence, for any shipwrecked men would naturally drift northward. The traditions of the island of Quelpart, off southern Korea, state explicitly that the people of that island came from the south. The names of very many of these maritime settlements or colonies along the southern coast of Korea have endings which are an exact counterpart of Dravidian words, meaning a settlement or village. There is a marked physiological similarity between the people of the Korean island of Quelpart and the natives of Formosa. This is strikingly illustrated in the superiority of the women over the men in physical structure, which is true both of Quelpart and of Formosa. These are a few of the lines along which the argument lies for a southern origin of the people of southern Korea. But as the southern people ultimately came to dominate the whole peninsula and impose their language and customs upon the entire population of Korea, we may say that the Korean people are mainly of southern origin, with, of course, a strong intermixture of the northern element. The readiness and ease with which this assimilation was accomplished may be partly explained on the ground that during all their peregrinations the different branches of the Turanian race, which, after surrounding China, struck on Korean soil, never lost the agglutinative character of their language. The vocabularies were probably distinct, but the grammatical structure had remained practically intact during the many, many centuries that must have elapsed since the original splitting of the family.

The population of Japan is probably of a similar mixed character. The Ainus, who formerly occupied that country, were in all probability of northern origin, but they were gradually driven out by the invaders from the south. If these invaders had come from the north the remnant of the Ainus would now be found in the south, but their very presence in the extreme north points to the southern origin of their conquerors. But we are met by a very curious problem in this connection. The phonetic systems of Japan and Korea are quite distinct, and the vocabularies of the two countries have almost nothing in common, while the grammar of the two is identical even to details. All a Korean has to do in order to acquire the use of the Japanese language is to put Japanese words in the place of Korean ones in a purely Korean sentence. Why should the grammar show such striking similarities when the vocabularies are so unlike? We may have a clue to this in the resemblance between the phonetics of the Japanese and of the Maori dialects of the Pacific islands. There is a very great similarity, for instance, between Japanese and Hawaiian in this respect, the principal point being the fact that in neither language can a syllable end in anything except a vowel sound. It is not improbable that the Japanese found their way northward from the Malay peninsula by a path which took them far out into the Pacific, while the Koreans took the more direct route up through the islands immediately adjacent to the mainland of Asia. During the long centuries which covered these wanderings vocabularies and even phonetic systems might easily become changed, while the grammar, a far more conservative feature of language, remained practically the same.

When we come down to more modern times we find that Korea exerted a very powerful influence upon Japan. Some two centuries before Christ, when the Chinese Emperor Chin Si proposed the building of the Great Wall of China and began to impress millions of men into this stupendous work, there took place a wholesale exodus of Chinese, who preferred voluntary exile to such a thankless task. Among these fugitives a goodly band crossed the Yellow Sea and found their way into the southeastern portion of Korea. A century and a half later, in 57 B. C., this colony of Chinese had obtained a strong foothold in Korea. They had brought with them the higher civilization of China, but had wisely united their interests with those of the native Koreans, adopting their language and customs and intermarrying with them; so that after six generations of them had passed away a new combination had been formed and, as is so often the case in cross-breeding, a superior product was evolved which was destined to dominate the peninsula. It was in 57 B. C. that this new element founded the kingdom of Silla, which, growing out from a small centre, rapidly absorbed the surrounding districts until it was conterminous with the present Korean province of Kyung-sang. In this kingdom a brilliant civilization sprang up. Literature, art, science, commerce, flourished. In the ancient capital of that kingdom, the present town of Kyöng-ju, there hangs to-day one of the largest bells in the world. It was cast some time before 500 A.D., and is larger than the enormous bell which hangs in the present capital of Korea. At that time the inhabitants of Japan were little better than savages; but they learned of this new kingdom across the straits, and soon Silla became to Japan what Rome became to Ancient Gaul. It is probable that many subjects of Silla crossed to Japan and became teachers and even rulers. There are curious legends which tell how men from Silla, being supernaturally carried across to Japan, were immediately chosen as chiefs of Japanese tribes. It is very probable that the very noblest families of Japan to-day are descendants of these visitors. It has been a question of some interest to determine the reason of certain marked physiological differences between these noble families and the common people of Japan. All the evidence goes to show that they were this ancient Korean stock who did not colonize in Japan, but who went individually and became the true gentry of that country. Their number to-day in all Japan will not exceed ten thousand. Color is given to this theory by the fact that this superior element was first found in western Japan, opposite the peninsula of Korea.

The geographical position of Korea, then, has been of immense importance in that it has played such a leading part in determining the ethnological arrangement of the peoples of Eastern Asia. It has formed the link between China and Japan, and it has formed the link between two widely separated branches of the great Turanian stock.

But in these days her geographical situation has acquired a new and startling significance from a strategic standpoint. After standing for many centuries between the apathetic Chinese and the insular Japanese, neither of which ever had the power to overthrow the other, though mutually hostile, she now stands between a rejuvenated, active Japan and an aggressive, ambitious Russia, each of which has special and urgent reasons for desiring to enjoy a predominant position in the peninsula. Her safety seems to lie in pitting the two against each other. It may be that, as Père Hyacinthe said of little Judaea, Korea "has been placed between the great empires as a negation to universal empire—a pacific obstacle to the shocks of their power and the plots of their ambition."

THE CENSUS OF PORTO RICO.

BY

HENRY GANNETT.

The War Department has made public, in three bulletins, the leading results of the enumeration taken in Porto Rico under its direction last autumn.

The census was taken as of date October 16, and occupied about six weeks in field work. The plan and administration were very similar to those of the United States census, the island being divided into seven supervisor's districts, corresponding to the seven governmental departments, and each of these into numerous enumeration districts, with an average population of about 1,000. The supervision and enumeration were done entirely by Porto Ricans, the only Americans employed in the work being General Sanger, the Director, Mr. Harrison Dingman, the Assistant Director, and four clerks.

The population schedules were very similar to those used in the United States census, and the information obtained was in character almost identical. The scope of the census was much more limited than that of the United States, since the subjects of mortality, the defective, dependent and delinquent classes, were not touched upon, and the industries of the island, with the exception of a small schedule relating to agriculture, were untouched.

The results of this census are of especial interest to us as being the first authentic and trustworthy statement of the condition of this people, recently added to our numbers.

The total number of inhabitants of Porto Rico was 953,243. The latest official Spanish census was taken in 1887, and showed at that time a population of 798,565, indicating a decennial rate of increase of 16.2 per cent., a rate about the same as that of Ohio during the decade between 1880 and 1890. The population by department in 1899 was as follows:

Guayama	111,986
Humacao	88,501
Ponce	203,191
Arecibo	162,308
Bayamon	160,046
Mayaguez	127,566
Aguadilla	99,645

Porto Rico, with an area of 3,600 square miles and a population of nearly a million, is, on the average, very densely settled, there being about as many inhabitants to a square mile as in the State of Massachusetts; there is, however, this difference, that while in the State of Massachusetts the greater part of the population is collected in cities, and a large part of it in a few great cities, in Porto Rico the urban element is small, and the population is distributed quite uniformly over the island. There are but four cities whose population exceeds 8,000—San Juan with 32,048, Ponce with 27,952, Mayaguez with 15,187, and Arecibo with 8,008 inhabitants. Thus, the total urban population, under the above definition, numbered only 83,195, or 8.7 per cent. of the population of the island, while the corresponding element of the population of the United States constituted 29.2 per cent. ten years ago, and probably the proportion is to-day much larger. In Cuba the corresponding proportion was even greater, being 32.3 per cent.

Considering as cities all bodies of urban population down to 1,000 inhabitants each, it appears that there are in the island 57 cities, with a total population of 203,792, or 21.4 per cent. of the total population of the island. The corresponding proportion in Cuba was 47.1 per cent., or more than twice as great. Hence, it appears that the people of Porto Rico are essentially rural.

As to sex, Porto Rico contained few more females than males. The disproportion, however, is not sufficiently large to be in any way significant.

The proportion of children under ten years of age was 31 per cent. of the total population, being much larger than in the United States, where it was 24 per cent. The ratio of children was higher in this island than in any State in the Union or in any country of western Europe. The proportion of children of school age, five to seventeen years, was also high, being 33.8 per cent., while it was 29.6 per cent. in the United States; but it is at advanced ages that the most marked differences appear. Persons over forty-five years of age in Porto Rico constituted only 11.8 per cent. of the population, while in the United States they constituted 17.2 per cent., or nearly half as much more—a fact that suggests for the island a large death rate and short life period.

Distributed by race, Porto Rico contained 59,390 negroes, 304,352 persons of mixed white and negro blood, and 75 Chinese, making a total colored population of 363,817, or 38.2 per cent. of the population—a proportion about the same as in the State of Virginia, and somewhat higher than that of Cuba. The proportion of colored ranged in different departments from 14.4 per cent. in Aguadilla to 53.9 per cent. in Humacao. In the latter and Bayamon more than half the inhabitants were colored. The proportion of colored was greater in the eastern part of the island than elsewhere.

Comparison with figures of earlier censuses shows that the colored element, although increasing numerically, has decreased in proportion to the whites, as is the case in the United States and in Cuba.

The proportion of the foreign-born in Porto Rico was trifling, being only 1.5 per cent., and more than half of this element were natives of Spain. Since most of these people of foreign birth were found in the two cities of Ponce and San Juan, the population of the remainder of the island is almost pure Porto Rican.

The conjugal condition of the people of the island is peculiar. Of the total population 69.7 per cent. were single—an exceedingly high ratio, more than 10 per cent. higher than that of the United States. Only 16.6 per cent. of the population were married, and 8.9 per cent. were living together as husband and wife by mutual consent—a condition produced by the great expense of the marriage ceremony. Thus, the total number of unions, either under the law or outside of it, constituted but 25.5 per cent. of the population, as compared with 35.7 per cent. in the United States of persons legally married.

The statistics concerning school attendance show that only 8.1 per cent. of the children of school age were reported as attending school—a fact which is directly correlated with the high percentage of illiterates. Of the persons ten years of age and over 77.3 per cent. were unable to read. This proportion is much higher than in Cuba, where only 56.8 per cent. were illiterate.

The third bulletin relates to citizenship. It discusses the males of voting age, classified by birthplace, race and literacy. Of this class of the population only 3.8 per cent. were of foreign birth, of which 2.8 per cent. were born in Spain. Of the natives 25 per cent. only were able to read. Classifying them by race, the literate whites constituted 29.4 per cent. of all whites, and of the colored the literates constituted only 17.2 per cent. Under an educational qualification, therefore, the suffrage of the island is restricted to 47,973 persons, or about one-fourth of all the males of voting age.

BRITISH HONDURAS.

BY

W. L. AVERY.

This colony, which has been developed from the original "settlement" of Belize (a name now applied to the capital only), is the single dependency of Great Britain in Central America, and lies between the parallels of 15° 54′ and 18° 30′ N. lat. and 88° 10′ and 89° 9′ W. longitude. It is about 900 miles south of New Orleans and 600 miles west of Jamaica. It contains, with the adjacent cays, an area of 7,562 square miles, or nearly the area of New Jersey. It is bounded on the north by the River Hondo, which thus separates it from the State of Yucatan. On the south the Sarstoon river divides it from Guatemala. On the east the boundary is the Caribbean Sea, and the western boundary is the Republic of Guatemala. The seaboard extends for 180 miles, and the long line of cays provides a breakwater so entirely effective that no gale from the East or the dreaded northers are ever felt on its shores. The surf may break with great force on these cays, but the inner waters are ever calm, or comparatively so. South of Belize every river mouth or "bar" is the place of a settlement either of a few huts or a considerable village. The geographical features of the northern and southern halves are entirely different. The northern half is generally flat, with a slight incline from the western frontier to the sea—virtually a plain of some 1,000 square miles. The southern half is entirely different, having the range of the Cockscomb Mountains, beginning at the Sibun and running south, with the highest peak some 3,700 feet above the sea-level. The western portion of this southern half is undulating, grassy country, with fine pasturage lands, and is uninhabited; but some gold-bearing quartz has been reported, as well as indications of other minerals. As there are no wagon-roads in the colony, all transportation must depend on the sea and the many rivers. The river-system is extensive, and the streams, running as they do from west to east every few miles, with their windings, afford the means of traffic to all necessary points in the interior. They are generally of a depth of six or eight feet, with very few rapids. The Hondo, on the north, is navigable for large boats—not vessels—for 50 miles from its mouth. The New river (I am giving them from north to south) flows parallel with the Hondo, and can be navigated for 70 miles. The Belize river is the longest in the colony, and, rising in the Blue Mountains of

Guatemala, it follows a very tortuous course of 150 miles—twice the length in a straight line from its source to its mouth. With a depth from 6 to 9 feet and an average width of 140 feet, it forms the great highway or waterway of British Honduras. There is a necessary portage at the Falls of Roaring Creek. The Falls are only 10 feet in height, but their charm consists in their surroundings. They are in a high defile, which, from the water's edge to the summit, is covered with a wealth of vegetation unknown outside of the tropics. The majestic mahogany, towering 100 feet skyward, the giant cotton tree with its far-spreading buttresses, the waving bamboo with its feathery leaves, and the dense and beautiful smaller growths, with the perfectly clear water tumbling brightly through its channel, make a scene well worth a few days' trip to see. The Sibun river enters the sea ten miles south of Belize after passing through a somewhat hilly country. The Manatee river, 25 miles south of Belize, is narrower than the others, and the bar at the mouth is the roughest in the colony. Some miles from its mouth a remarkable stoppage occurs, the river being there supplied from an underflowing body of water—a stream flowing through a narrow cave of a mile in length. Mahogany is still floated down, however, though at flood-time it is a dangerous venture. The Mullins river is navigable some 30 miles from its mouth, and is very deep and slow-flowing, with most of the valley under banana and plantain cultivation. The Sittee river is by far the prettiest, though the rapids some twenty miles from its mouth make it perhaps the least useful. The scenery is so essentially tropical and wonderfully beautiful that the tediousness of its difficult navigation is forgotten. The Southern Stann Creek river rises in the mountains and flows through a country rich in game; but its navigation is slow and uncertain, the stream being obstructed with rocks and boulders, and Chase Falls and Big Falls adding to the difficulty while enhancing the beauty. Twenty miles further south is Monkey river, a stream which 12 miles from its mouth is a deep and narrow creek. The next water-course is Deep river, which is formed by the uniting of four creeks of equal size 12 miles from its mouth. Deep river boasts a "boiling spring" of hot water impregnated with sulphur and iron, and with a temperature of 84°. Lying between Deep river and the Sarstoon are Golden Stream, Middle River, Rio Grande, Rio Moho, and Rio Tomash, all flowing through a country entirely undeveloped and practically uninhabited. I have enlarged on the river-system because it renders possible the development of agricultural industries, and with the coming of the railway it settles forever any question of efficient transportation.

The towns of British Honduras are Belize, Corosal, Stann Creek, Punta Gorda, and Orange Walk. The first recorded mention of a settlement at Belize was in 1638, when a few mariners and adventurers formed the nucleus of what has become entirely a wood-cutting and trading community. At first a settlement, then a superintendency, later a dependency of Jamaica, in 1884 a full Crown colony was established, and Belize is its capital. All the public buildings are situated here, and it is the chief city as well as the capital. Corosal, the second town in importance, is situated almost on the extreme north of British Honduras, eight miles from the Mexican boundary, and, unlike Belize, it is high above the water-level, on the edge of the largest plain in Central America. This town is of Spanish origin, as is proved by the records of the refugees from Yucatan who settled it and from the general plan of the laying out, with a plaza in the centre about 100 yards square, with the Roman Catholic church facing it on one side, and the streets running at right angles, unlike any of the other towns in the colony. The people, too, are unlike the other inhabitants of the more southern districts. Stann Creek is built along the shore for over a mile, and the beach is dignified by the title of the "Marine Parade"—for its people consider it the Brighton of the colony. It is the one town that does not depend on the rainfall for its water supply, as a clear, pure stream flows through it. The inhabitants, some 2,500, are largely of Carib origin, and rely for their support on the sale of fruit to the steamers. Punta Gorda, elevated about twelve feet above the water, is also built along the water front for some three-quarters of a mile. Here is located a small community of citizens of the United States, who coming there shortly after the Civil War and engaging in sugar-making and cane-planting have made a success of it, and only lack capital to make it an immense enterprise. The sugar is wonderfully rich in quality, and the example of these honest Southerners will lead to a great development of the industry in the future. There are 12 sugar mills and over 1,000 acres under cane. The undulating grass lands in the vicinity of Punta Gorda, with here and there a noble tree, give the landscape a park-like appearance very agreeable to the English eye.

The coast of this colony is well lighted. And, indeed, it needs to be; for though the weather is ever clear, the uncertain but very powerful currents along the shores and among the cays render good lights necessary, for the great essential of the navigator—viz., experience—counts for little when the force and direction of the current is unknown.

THROUGH THE SILK AND TEA DISTRICTS OF KIANGNAN AND CHEKIANG PROVINCE.

BY

EMIL S. FISCHER.

The interest of the whole world is again centred in China, on account of the Boxer Rebellion. Since the quelling of the Tai-ping rebellion in 1864 the Chinese Government has had little trouble to face in the interior of so great a country, but after the Chinese-Japanese war in 1894 the reigning Emperor had to subdue the Mohammedan revolt in Kansu and several other uprisings in different parts of the country. Another menace was the secret societies, whose aims were the exclusion of foreigners from China and the murdering of missionaries and converts. It is hoped that the present disturbances in the Middle Kingdom will soon be pacified, so that foreigners may be able to travel safely in the interior. There is no doubt that one of the sources of the opposition to foreigners arises from the economic danger that the coolie classes apprehend in the new means of communication and transportation, which threaten to deprive them of their chief means of income as carriers and runners. The Chinese prefer their slow and primitive way of travel—and the methods of getting about in China are very different from ours. During my stay of five years in China I made frequent journeys into the interior, and was compelled to accommodate myself to the Chinese methods of travel. Once I was about to visit the well-known Ping-Shui valley, in which region most of the famous green tea of that name is cultivated, much of which is consumed in America. I soon found a convenient Mandarin boat, which took my Chinese teacher, my boy-servant and myself to the Imperial city of Hang Chow, with its beautiful views. The vessel on which we travelled was a very commodious one, of flat construction. My teacher occupied the compartment on the forepart of the ship. My room, which contained an opium sofa, stools and a table, was a little larger. The only thing which interfered with our comfort was a plague of insects. My boy-servant put himself in a place adjoining the bunks of the dozen coolies who served as sailors. These were supervised by the Laodah, or boatman.

Our journey was fairly agreeable at the start. We made arrangements with a so-called steamboat train. This is a daily-running steam launch, which, since the opening of Hang Chow as a treaty port in 1897, plies about these waters, towing several Chinese freight and passenger boats. It takes about two days, at the rate of about five miles an hour, to reach Hang Chow. The country which we traversed is known for its fertility, but the general aspect of the territory along the Whang-pu and the Grand-Canal is monotonous. We passed through several populous cities. We were especially taken with the cities of Ka-Zay and Ka-Shing, situated upon the borders of the Imperial Canal. On the outer wall of Ka-Shing we noticed the three interesting sister pagodas, San-ta-se. While I was on deck I was the object of curiosity to the assembled natives, who immediately called me "Yang Kwei tze," denoting foreign devil. We reached the foreign settlement of Hang Chow after midnight of the second day of our journey, having been stopped about midnight at the Custom-house of the foreign settlement, where we were registered. We immediately started for Hang Chow City, which is about six hours' travel from the settlement, then consisting of the Custom-house bungalow, a semi-foreign-built house, a missionary hospital and several godowns, which are storage places for the merchandise of the port. The tugboat, which could proceed no farther, now left us. According to Chinese custom, we should have had to remain in the settlement all night; but I compelled the Laodah to proceed, and also asked him to wake me if for any reason the boat should have to stop. About three o'clock in the morning I was informed that we had arrived at an obstruction in the canal. It was one of those primitive canal locks consisting of a mere embankment, with a provision for raising the boat by a derrick. The coolies in charge of the station were fast asleep. Our boat had to move to shore, and as soon as this was done I sprang on land with a big Japanese stick. With this I almost broke the door of the hut where the would-be watchman was enjoying a good rest. I finally awakened him, and with some small coins persuaded him to hurry to seek a dozen coolies, who were to take our boat over the lock, known as "Hole-over." The Imperial Canal has a great many such locks in the neighborhood of Hang Chow; they are of ingenious, antique construction, and prevent the floods of the Yellow Sea from overflowing the country.

It took some time before our boat was fastened with very strong manila ropes. The coolies tried their best to bring us over as quickly as possible, as they seemed to intend to continue their slumber; but the pulley did not work fast enough, and it took much time, with all possible energy, to raise the heavy Mandarin boat to the top of the embankment. From this embankment it slipped down to the opposite side of the canal by its own weight. We were now ready to continue our journey to the city gate of Hang Chow, where we arrived about five o'clock in the morning.

The gate was still closed. No entrance is permitted until sunrise. We anchored in the midst of hundreds of boats in a large basin of the canal. Most of the boats around us were filled with articles of food, which were intended for the Hang Chow market.

It was long after six o'clock, and the city gate was still closed. I waited patiently on deck for the moment of opening, but when at half-past six we were still in waiting, I began to fire cartridges, and made such a noise that finally one of the officials appeared on the top of the wall to discover the cause of the alarm. I called to him to hurry and open the gates. He promised to do so, but it took some time before the guards were dressed and ready to open the heavy wooden entrance. A very curious sight struck me when we entered the archway of the gate; about fifteen or twenty guards were at the gate around and robbed every boat as it came along. Those boats which passed in the middle of the stream were the only ones that escaped the general pillage.

Our boat continued the voyage through the suburbs of Hang Chow. It took another hour before we completed the first stage of our journey. We had to stop in a muddy stream. Around us were a great many flower-boats, where the gayeties of life begin with sunset and are carried on with all the decorous solemnity of thorough Bowery life. At this hour on these boats all the singing girls and Chinese musicians were fast asleep. But I could judge from the neighborhood that we had landed on the Hang Chow Bowery.

While my boy packed our belongings, I went on shore with my Chinese teacher and made arrangements with chair-carriers to take us through the very populous city and noted surroundings. We also hired a dozen coolies to carry all our packages to Hsi-Hsing, a city opposite the mouth of the river, named Tsien Tang Kiang, on which Hang Chow is situated. Hsi-Hsing is over thirty li, or more than ten miles, distant. My teacher and I took the palanquins, or chairs, and we began our inspection. We were carried to the western gate of the city, where the walls rise by the charmingly pretty Western-Lake. The lake is surrounded by beautiful hills, on which stand inviting temples and pagodas, and it is dotted with little islands, which are connected with one another by means of peculiar Chinese arch bridges. We left our chairs and took a little trip around the lake. Then we went to the top of a hill, upon which stood a pretty little house, built in European style, next to an old ruined pagoda. I discovered that this attractive residence was the summer home of the Church of England missionaries of Hang Chow. We were enchanted with the grand view from this point. We proceeded on our journey and stopped at several Yamen, the official residence of the Chinese Mandarins. We also entered the great and handsome city temple, which Buddhistic house of worship is situated on a hill within the walls of the town. In the business street of the city we entered several silk shops and looked at the beautiful Hang Chow silks. This city boasts of an Imperial silk factory, the looms of which turn out yearly thousands of pieces of the finest kind of silk, mostly consumed by the Imperial household in Peking. My teacher visited several tea-houses and bought some of the finest kind of Ping-Shui tea.

We arrived at the ferry just before the last afternoon boat crossed the mouth of the Tsien Tang Kiang. This capacious boat did not look very clean. It was filled with vegetables and all kind of food stuff, besides general freight, a number of coolies and other passengers. We were happy to possess chairs, in which we were carried on the boat and placed in some sort of a reservation for palanquins, but could not escape the odors that emanated from the variegated cargo. I could not remain in the chair, but went to the stern of the boat, where I could at least get some fresh air behind the open sail. It took about a half-hour to reach the southern bank of the stream. We were, luckily, in time to see the bore or great flood which, during the equinox, approaches the coast of Hang Chow with thunder-like noise; it appears like an enormous water-wall, which rises up to 24 feet, arriving with great velocity at the embankments of the Hang Chow Gulf, entering also the Tsien Tang Kiang. The gulf and the river are very dangerous at such times to the shipping world.

We proceeded now to Hsi-Hsing, which was about 15 li distant. Our coolies carried us to a tea-shop, where our boy was awaiting us with our belongings. The place was filled with a number of dispatch-boatmen, who offered their boats. I soon perceived by their enormous prices that they had formed a kind of trust. I succeeded after some hunt in procuring the upper deck of a freight-boat, which seemed to me safer and more comfortable than travelling by dispatch-boat. At night I discovered, to my dismay, that my fellow-passengers on the lower deck were largely composed of pigs and geese, who did not hesitate to make the night hideous with their peculiar noises. Along the river to Shoa-shing is a chain of mountains, forming the eastern extremity of the Himalaya.

We arrived at Hsiao-Hsing at dawn. First I ascended one of the surrounding hills to seek invigoration after the ill effects of the night journey. The hill was situated near the city wall, and I had a splendid view of Hsiao-Hsing's prominent dwellings, pagodas and temples, most of which were on the banks of creeks. Hsiao-Hsing is termed generally "the Venice of China," only because of the many creeks and canals which break the city up into numerous islands; but in no other respect can it be fairly compared to the beautiful, poetic Venice.

Before my departure I visited the temple of the 500 Apostles of Buddha, called the Lohans. They consist of a gallery of fine gold carvings. On departing, and before passing the South-Eastern City gate, we saw a great number of Chinese statues, generally known as "Women Monuments." These monuments are erected by edict of the Chinese Emperor, and they set in most cases an example to the posterity of faithful women. One of these monuments attracted my special attention. It bore both a Chinese and a European inscription. I went ashore and examined it, and found that it was a memorial to the French soldiers and sailors who fell in subduing the Taiping Rebellion of 1862–64.

From this place we started with two dispatch-boats for Yu-Yao. These boats, also called post-boats, are about 9 or 10 feet long and about 3 or 4 feet wide, tapering to a point at both ends. They are covered with a thatched roof, supposed to serve as a protection in all kinds of weather. The boat is generally manned by one coolie, who propels it by pushing the oar with his foot and holding the steering rudder in his hand. These dispatch-boats are specially adapted for travel in shallow waters. The boatman, while using his leg in propelling the boat, prepares the meals, and attends to both duties without trouble. He cooks his food with the unoccupied hand, and crams the rice into his mouth with the "chopsticks" in a quiet way and without any inconvenience. We were soon out of the city gate. The boat I travelled on led the way, and behind followed the second boat, containing my teacher and boy-servant. The channel soon broadened, and we drifted on the Tzao-Wu-Kiang, which lies between mountains and beautiful valleys and passes through the famous Ping-Shui valley. A few miles from Hsiao-Hsing we saw a romantic Mandarin garden for the amusement of pleasure-seekers. The typical spot for amusements in China is one containing many bridges, caves and labyrinths. Such was this park, built close to the mountains and to the water. I intended to reach the Hole-over watershed at Shang-Yu in the evening, otherwise we should have had difficulty in getting over the broad embankment before the next morning. I therefore urged the two boatmen to hurry down the stream; I was satisfied, because we covered a distance of 100 li, or about 33 miles, in nine hours. Our progress by boat was here impeded by a stretch of intervening land, over which our boats had to be carried on the backs of coolies to reach the continuation of the waterway. We resumed our water journey until we reached the gates of Pa-Kwan. I was awakened from my sleep by the coolie, who told me that the Mandarin soldier refused to let us pass the gate. My argument with the soldier proving futile, I directly entered the Yamen near-by, where I found one room lit up. I went straight in and surprised a lot of Mandarins coolly smoking their opium pipes, while others were playing games. It was comical how they jumped on seeing a stranger. I addressed them most politely in the Mandarin language, and demanded that we be allowed to continue our voyage. They granted my wish most courteously, and one of the Mandarins himself went to open the gate. We were now on the straight way to Yu-Yao, where we arrived at about six o'clock in the morning. We came to the landing-place of the Yu-Yao-Ningpo steamboats.

My teacher and also my boy-servant, carrying our baggage, took the opportunity to reach Ningpo before evening by means of this Chinese morning boat. I preferred riding a whole day down the river on a dispatch-boat, to which I had accustomed myself, for I could not stand travelling on one of those ill-smelling Chinese steamboats. I expected to reach Ningpo late in the evening, so went ahead with my dispatch-boat, and stopped at a pretty little hill, where I thought of getting off. I made the coolie understand that I wished him to meet me a little farther down the stream, where another spur of the mountain approached the river. When I arrived there he was awaiting me. I had this same experience with my boatman several times, and was always successful. The country was very interesting. Sometimes I went to a small village. Rice was cultivated in most of the fields, and the hillsides showed pretty tea plantations. About noontime, when I again left the boat to take a look into one of the valleys, I underrated the distance. I therefore tried to get straight down from the midst of the valley, traversing muddy rice-fields, until I reached the river, believing that I could meet my boat along the bank of the stream. After a very long and fatiguing walk through these fields, I came to the water front, where, to my great disappointment, I could not find my boat. I called for my boatman, but without avail. I was almost in despair what to do, when some cormorant fishing-boats passed down the river. I attracted their attention. They rowed over, and agreed to take me down the river in their most uncommodious raft, on which two fishermen and a dozen birds were placed.* After more than an hour's floating we passed a larger place on the bank of the river, and I became convinced that in order to find my boat I must retrace my way. I landed, and at once took a sailing craft going up the stream. The wind blew at a good rate, and my perseverance was finally rewarded by finding my boat, which bore my coat as a flag. When questioned the coolie explained that, as he had not found me, he rowed back and quietly waited at the place where I had left him.

The day soon darkened, and the coolie rowed down the river. I dreaded to sleep in this most uncomfortable position on the floor of the boat, and luckily found a substitute oar, and with this I helped the coolie row, and thereby we completed our trip in half the time it would otherwise have taken. At about 4 A.M. we approached Ningpo. It was not very easy to steer clear of the many junks and other vessels, without any light, anchored in the harbour. We succeeded in this also, and finally arrived at the landing-place of the foreign settlement, where about thirty foreigners live. I went afterwards to the bungalow of the Custom-house, where my friends expected me.

I did not return to Shanghai by the overland route. I had accomplished my desire of studying the silk districts of Hang Chow and the tea plantations of the Ping-Shui valley. There are few foreigners, with the exception of explorers and missionaries, who dare to undertake such tedious voyages. The means of communication are in no way inviting, and railroads are still in the distant future.

After a sufficient rest in Ningpo, I took the coast steamer to the so-called Eastern model settlement of Shanghai.

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* Cormorants are commonly used in China for fishing purposes. A ring, fastened around the neck of the bird, prevents the cormorant from swallowing the quarry.

PHYSIOGRAPHIC NOTES.

BY

RALPH S. TARR.

FRESH-WATER DEPOSITS OF THE WEST.—In recent papers (see, for example, *Proc. Amer. Acad. Arts and Sciences*, XXXV, 1900, 345–373) Prof. Davis has raised a question concerning the geology of the West which has attracted a great deal of attention. It is a well-known fact that throughout the West there are extensive deposits of sand and gravel which have been almost universally ascribed to lacustrine origin. Upon the basis of these deposits the recent history of the mountainous West has been interpreted somewhat as follows: First, broad seas with projecting mountain spurs; second, with the growth of the mountains, a narrowing of the seas and a closing of the inlets, transforming the seas to estuaries, and later to lakes; finally, with the continued growth of the mountains and the dragging of rock fragments down the mountain slopes, the lake basins have been destroyed. During this period the mountainous West was a region of numerous and extensive lakes.

The purpose of Prof. Davis's paper is to question the lake origin of the deposits as a universal explanation and to suggest as an alternative hypothesis that a fluviatile origin will apply to certain regions. This explanation has certainly been in the minds of some geologists, as, for instance, in explanation of the peculiar and very extensive beds which fill the valley of California; but it is to Prof. Davis that we owe the first clear and specific statement of this point of view.

After a summary of the published statements concerning these supposed Tertiary lakes, Prof. Davis considers the characteristics of lake deposits and discusses the characteristics of fluviatile and other deposits, and he also considers special instances of accumulations in the West which have been ascribed to lake origin. He declares that the object of his papers is to promote consideration rather than to announce conclusions. There seems little doubt that in studies of the West the lacustrine origin has been assumed in many cases without critical consideration of other possible explanations, particularly that of fluviatile origin; and it is by no means impossible that a careful analysis of the facts in each instance will show that at least some of the so-called lake beds have in reality been accumulated in basins by the washing of river and rain waters and without the intervention of lakes.

GLACIAL EROSION.—The tide of opinion seems to be setting toward a belief in the effectiveness of glacial erosion where local conditions favor. That is to say, after the revulsion following the extreme views upon the subject held by early geologists, students of the subject are now taking the middle ground. This change of opinion is very well illustrated by two recent papers from the pen of Prof. Davis. (*Appalachia*, ix, March, 1900, 136–156; *Proc. Boston Soc. Nat. Hist.*, xxix, 1900, 273–322.) Eighteen years ago a paper published by Prof. Davis took a rather strong stand against the extreme view of great glacial erosion; but he now says: "In a retrospect from the present time, it seems to me as if one of the causes that led to my conservative position was the extreme exaggeration of some glacialists, who found in glacial erosion a destructive agency competent to accomplish any desired amount of denudation—an opinion from which I recoiled too far."

During recent travels in Europe Prof. Davis has seen evidence in various places that ice has operated locally to a marked extent, and it is a description of these observations which constitutes the main basis for his papers. His most important evidence of glacial erosion is that which is offered by certain valleys down which ice has moved with rapidity, lowering the bottoms of the main valleys below the floors of the tributaries. This condition he calls "over-deepened main valleys and hanging lateral valleys." One of the most typical cases which he has seen is that of the Ticino valley in the Alps; but he describes others in Norway and refers to other instances.

The paper in the Proceedings of the Boston Society closes with a review of previous writings on the same subject, and this review of the literature is interesting in that it shows to what extent glacial geologists are returning to the belief that ice can erode very markedly where conditions are favorable. To the writer of this note Prof. Davis' conclusions are of considerable interest, since the basis for his conclusions, resulting from his European studies, is almost exactly the same as that which I presented in 1894 in explanation of the Cayuga Lake Valley. (*Bull. Geol. Soc. Amer.*, v. 1894, 339–356.)

THE ILLINOIS GLACIAL LOBE.—For many years, under the direction of Prof. Chamberlin, much detailed work has been done upon the glacial geology of portions of the middle West. Among the assistants of Prof. Chamberlin the one who has done the most continuous work is Frank Leverett, and from him glacial geologists expect important results. He has already published a number of papers, but the first extensive work which has appeared from his pen is his recently published Monograph on the Glacial Lobe of Illinois. (*Monograph U. S. Geol. Survey*, xxxviii, 1899.)

The ice which covered this portion of the country was supplied from the northeast, and, according to Leverett, its history has been very complex. Much of the Monograph is devoted to a description and consideration of the several till beds and the intermediate weathered zones, together with a description of the moraines and other glacial features. It is impossible to abstract so long a monograph in the space that is available here; but one of the striking portions of the work is the chapter devoted to the question of the depth of the drift in Illinois—a State that is well calculated to furnish information on this point because of the large number of wells and borings. Leverett has carefully gathered the information which these furnish, and from his study concludes that the average depth of the drift in Illinois is from 100–130 feet.

The chapter devoted to the study of the glacial Lake Chicago is also of especial interest. This lake, which overflowed into the Des Plaines and thence into the Illinois river, covered the site of the city of Chicago, and the beaches marking the various levels are still to be seen, some of them within the very city itself. There is also a portion of the Monograph devoted to a consideration of the changes in the rivers as a result of the glacial invasion. It is just such studies as this which glacial geology needs to serve as a basis for explanation of phenomena which, though obscurely understood, nevertheless have no lack of hypotheses in explanation.

THE GLACIAL GRAVELS OF MAINE.—One of the most striking features in the glacial geology of Maine is the presence of extensive beds and ridges of gravel. The latter, known as osars or eskers, though locally called by other names, such as hogback, are to be frequently seen in driving across the country. In fact, many of the roads run along the crests of these eskers for a considerable distance. They vary in height from three feet to over one hundred; some of them are in the open country, but a great many are in the woods, and, in consequence, are very difficult to study.

Attracted by the remarkably clear development of these forms, Stone undertook to work out the problems which they presented, and completed his work in 1889, although the results were not published by the Geological Survey until ten years later. (*Monograph U. S. Geol. Survey*, xxxix, 1899.) This monograph consists of descriptions of the general features of the glacial geology of Maine and a detailed description of the extensive gravel deposits, particularly the eskers. In Maine these are found to be confined to the river valleys, in the main stretching continuously for long distances, though often broken by gaps of considerable size. The several esker systems are named and the deposits mapped, and the monograph closes with a discussion and a classification of the features of individual deposits, being particularly detailed on the subject of eskers. It is to such painstaking studies that we must look in the future for the basis upon which to generalize concerning the conditions during the Ice Age. Besides the credit which belongs to one who gives so much time to extensive local studies, additional credit is due for intelligent work in the midst of such difficulties as those which must have been met with by Stone during his studies in the wooded portions of Maine.

GEOLOGY OF NARRAGANSETT BASIN.—From a number of standpoints the region about the shores of Narragansett Bay is of marked interest, and the publication of a monograph by Shaler, Woodworth & Foerste (*Monograph U. S. Geol. Survey*, xxxiii, 1899) furnishes an answer to many of the questions that have been raised concerning the geological history of this rather remarkable region. In a deep basin of Carboniferous time there were accumulated a succession of beds similar to those of other coal regions. Then, succeeding the period of deposition, there came a time of uplift, doubtless connected with the Appalachian revolution, which succeeded in producing very much more marked effects of metamorphism upon the coal measures of this section than was the case in the Appalachian coal-fields. The mountain-folding which has been responsible for the metamorphism has consisted not merely of rock-folding, but of much faulting, and the geological structure of the region has been still further complicated by the intrusion of masses of igneous rock. The subsequent erosion of this complex of rock material has resulted in the formation of the present basin, depressed between massive crystalline rocks on either side, and, through recent sinking of the land, transformed at the lower margin to an arm of the sea.

MAP NOTICES.

BY

HENRY GANNETT.

Since the publication of the last Bulletin the U. S. Geological Survey has made notable additions to the map of the United States in the form of thirty-eight sheets, a majority of which are in the eastern part of the country.

In New Hampshire are two sheets, on a scale of 1:62,500, with a contour interval of 20 feet, known as Peterboro and Whitefield. Both these sheets represent undulating or hilly country, diversified with occasional monadnocks. Near the centre of the Peterboro sheet is the well-known peak Monadnock, a typical mountain of this character.

Four sheets, situated about the junction of the three States of Massachusetts, Vermont and New York, have been combined in forming the Taconic sheet, which, on a scale 1:125,000 and a contour interval of 40 feet, represents admirably the relief features of this hill country.

In New York are no fewer than eleven sheets, all on the scale of 1:62,500, with a contour interval of 20 feet. Wilmurt and Canada Lake are in the Adirondacks, representing hill country, abounding in lakes and marshy streams, the result of the extensive glaciation of the region. Remsen is farther to the west, and shows a country of comparatively low hills, which also has been extensively glaciated. Schoharie lies in the Helderberg Plateau, and shows a dissected region, with broad, well-graded stream valleys. Little Falls includes part of the valley of the Mohawk, with the hill country bordering the Adirondacks in the northern part of the sheet. Baldwinsville, lying farther to the westward, represents a region of glacial deposits, including many beautiful examples of drumlins. Oswego, lying north of the latter and bordering on Lake Ontario, is also diversified with many beautiful drumlins, whose axes show a remarkable parallelism, trending about south-southeast. Fulton lies east of Oswego, also bordering upon Lake Ontario on the north, and presents similar characteristics. Canajoharie includes a part of the valley of the Mohawk, with the escarpment of the Helderberg plateau in the south. Cherry Creek, in the western part of the State, represents a dissected plateau, with broad stream valleys. Dunkirk shows a portion of the low shores of Lake Erie, with the plateau rising abruptly a few miles inland.

In New Jersey are two sheets, Raritan and Passaic, each of which is a combination and reduction of four sheets, the scale being 1:125,000, with a contour interval of 20 feet. Passaic includes Jersey City, Newark and the Oranges, with the beautifully curved ridges on the outskirts of the Appalachians. Raritan lies directly west of it, and is mainly occupied by the parallel ridges of the Appalachians and the narrow valleys separating them.

In Pennsylvania are three sheets, the first results of the resumption of work in that State produced by the co-operation of the State with the Federal authorities. These sheets are upon a scale of 1:62,500, with a contour interval of 20 feet. Erie includes the city of that name, with the lake shore, and in the southern part the escarpment of the Allegheny Plateau. Fairview lies directly west of Erie. The third sheet, lying south of Fairview, is occupied in the main by the lower slopes of the Allegheny Plateau, in which, as in other similar regions, the streams, recently revived after being graded, have become deeply incised.

Co-operation between the State of Maryland and the Federal authorities has resulted in considerable work, and among the sheets produced are seven lying entirely or partly in this State. All these are upon a scale of 1:62,500, with a contour interval of 20 feet. In the low country in the eastern part of the State is the Betterton sheet, including the country near the head of Chesapeake Bay—a low region, whose altitude nowhere exceeds 100 feet above sea-level, while much of the shore of the bay is marshy. Havre de Grace lies north of Betterton and represents the head of Chesapeake Bay and the lower course of Susquehanna River. Cecilton lies east of Betterton, in the northeastern part of the State, and represents a low, level region, with estuaries at the mouths of all the rivers. Elkton is north of Cecilton and represents a similar region, with its relief a little more accentuated. The other three sheets of Maryland are situated in the western, mountainous portion of the State, and bear the names of Accident, Oakland and Flintstone.

In Illinois is one sheet, Highwood, upon a scale of 1:62,500, with a contour interval of 10 feet. It is situated north of Chicago, and represents a level, glaciated country, with steep bluffs along Lake Michigan.

In Iowa is one sheet, Anamosa, upon a scale of 1:125,000, with a contour interval of 20 feet. It represents a somewhat broken prairie region, in which the streams are deeply incised.

At the junction of the States of Wisconsin and Iowa is the Lancaster sheet, upon a scale of 1:125,000, with a contour interval of

20 feet. The Mississippi river flows across this sheet in a bottom-land two miles in breadth, bordered by steep bluffs several hundred feet in height. Its tributaries are all deeply incised in the prairie.

In western Kansas are two sheets, Lakin and Syracuse, both on the scale of 1:125,000, with a contour interval of 20 feet. These sheets adjoin one another, and are traversed by the Arkansas river in a broad bottom-land, bordered on the north by bluffs of considerable height, while upon the south is a broad stretch of sand-dunes.

In Indian Territory are three sheets, known as Sanbois, Atoka and Coalgate; these are upon a scale of 1. 125,000, with a contour interval of 50 feet. They lie mainly in the Choctaw Nation, although the first-named includes a portion of the Cherokee country. This sheet is the only one which shows decided relief, its southern part being occupied by the crooked ridges of the western extension of the Ozark Hills.

In Colorado is one sheet, Engineer Mountainon, a scale of 1:62,500, with a contour interval of 100 feet. This is in the San Juan Mountains, in the southwestern part of the State, and contains several high summits, the most prominent of which, as well as the highest, is Engineer Mountain, with an altitude of 12,962 feet.

In Nevada is one sheet, Silver Peak, upon a scale of 1:62,500, with a contour interval of 100 feet. This sheet represents the Silver Peak Range, a broad, irregular mountain mass, together with desert valleys at its base. It presents a number of excellent illustrations of alluvial cones built by the streams which flow from the mountains into the valley and there disappear.

In California are two sheets—Fernando in the southern part of the State, upon a scale of 1:62,500, with a contour interval of 50 feet. This represents the western part of the San Gabriel Mountains, with the San Fernando Valley at their south base. The other, known as San Luis, is upon a scale of 1:125,000, with a contour interval of 100 feet. It includes a large area of the coast ranges in the vicinity of San Luis Obispo, together with a long stretch of the Pacific coast.

The War Department has recently issued an excellent map of northeastern China, representing that portion of the "Flowery Kingdom" which is most in the public eye at present. The scale is about 20 miles to an inch, and the map includes the territory from latitude 30 to 42° north, and longitude 112 to 124° east.

NOTES ON CLIMATOLOGY.

BY

ROBERT DeC. WARD.

The Influence of Climate on Military Operations.—The more closely we study the relations of climate and man, the more striking is seen to be the control which climatic conditions exercise over the many activities and peculiarities of the human race. That the influence of climate may clearly be seen in many of the migrations of men from one country to another has long been recognized. Even the smaller details of such migrations, whether peaceful or warlike, often point distinctly to climatic or meteorologic control. In the latter connection reference may be made to a recent publication, in which emphasis is laid upon the influence of climate on military operations. The volume is entitled *Outlines of Military Geography*, and is by T. Miller Maguire, LL.D. (Cambridge Geographical Series, Cambridge, England, 1899.) The discussion in question is contained in Chapter XIV, of which the title is *Influence of Climate on Military Operations*. After pointing out the importance of military organization and good hygiene, and noting that "the inhabitants, however well used to the climate, will perish if unprepared, while the invader, if provided with all requisites of clothing, food and drinks, will thrive," Lieut. Maguire enumerates a number of cases in modern warfare in which accidents of climate and weather have resulted in disaster to armies. Napoleon's unfortunate invasion of Russia, rashly undertaken, furnishes a terrible illustration of the effects of a severe northern winter. In 1877, the Russians lost over 6,000 men at Shipka during the frost and snow of the storm of December 18–23. In January, 1814, a sudden thaw obliged the French troops to undergo the most terrible fatigue in forcing their way through the deep and miry alleys of the forest of Der during their movement from St. Dizier to Brienne. During one of Gen. Grant's campaigns in Virginia, after several days of fair weather, there came a very heavy rain, which lasted a day and a night. As related in Porter's *Campaigns with Grant*,

> "the country was densely wooded and the ground swampy, and by the evening whole fields had become beds of quicksand, in which the troops waded in mud above their ankles, horses sank to their bellies, and waggons threatened to disappear . . . . The roads soon became sheets of water, and it looked as if the saving of that army would require the services, not of a Grant, but of a Noah."

Other instances of a similar kind are cited, and, as a whole, the chapter is extremely suggestive both to the student of climatology and to the student of military science. A recent illustration of the difficulty of campaigning during a rainy season has been furnished by the experience of the American troops in the Philippine Islands, to which reference was made in these NOTES in Vol. XXXII of the BULLETIN (No. 1, 1900), pages 43–45.

THE BOXER OUTBREAK IN CHINA AND THE CHARACTER OF THE SEASONS.—Closely allied to the subject referred to in the preceding paragraph, and a very recent instance of the influence of weather conditions upon history, is the fact that the "Boxer" outbreak in China, which has precipitated a war of international importance, whose end it is as yet impossible to foretell, was to some extent due to the character of the season immediately preceding this outbreak. In an article on The Chinese Boxers, in the *National Geographic Magazine* for last July, Mr. L. J. Davies emphasizes the importance of the seasonal control over the welfare and the conduct of the people of Northern China in the following words:

> "It must be borne in mind . . . that economic conditions greatly assist the organizers (of the Boxer movement). In good seasons the people of North China must secure two crops each year from the same land in order to maintain a condition of average welfare. If the spring yield fails there is considerable suffering, and if spring and fall crops are bad, conditions of local famine result. A considerable proportion of the people are therefore always on the verge of destitution. In seasons of distress, highway robbery is very frequent. The more wealthy travellers carry arms, and during the winter months housebreaking is so common that one or more members of well-to-do families watch all night. Hence, beginning by looting the homes of Christian Chinese, the 'Boxers' proper attracted to themselves a great company of the hopelessly poor, who, joining them for plunder, would be as ready to fall away when the booty was no longer to be obtained."

Another writer on the "Boxer" outbreak, Arthur Sowerby, in the *Contemporary Review* for July, also mentions among the causes of the outbreak the scarcity of rain in the preceding autumn, and calls attention to the fact that the winter days, when the villagers and canal population are idle, were spent by these people in drilling.

SWISS GLACIERS AND OSCILLATIONS OF CLIMATE.—In the *Rapport de la Commission Internationale des Glaciers*, presented to the International Geological Congress held in Paris during the past summer, the results of the studies of the Committee in regard to the glaciers of the Alps are thus summarized: After 1810 there was a marked and rapid advance of the ice, which reached a maximum about

1820. Between 1820 and 1850 there came a slight recession in cases where the glaciers did not remain stationary, and towards 1850 a new advance took place, similar to the first (1810–1820). Next a general and considerable retreat took place, which was so marked between 1860 and 1880 that it almost seemed as if the Alpine glaciers would disappear entirely. About 1880 the retreat of the glaciers of the western Alps, especially those of the Mont Blanc group, began to stop, and a new advance commenced in some cases. In the eastern Alps the glaciers did not follow suit until 10 or 20 years later. In general, it can be said, with certainty, that the period of great retreat has ceased, and has been replaced by movements in the opposite direction. The interesting point in connection with these studies, from the standpoint of a climatologist, is the relation of these variations in the glaciers to climatic oscillations. The *Commission Internationale des Glaciers* shows that these variations in the Alpine glaciers correspond to the 35-year period of climatic oscillations discovered by Brückner. The periods 1806–1825, 1841–1855 and 1871–1885 were rainy. Each one of these periods brought a corresponding advance of the glaciers, which was very strongly marked in the first two periods, and was suggested in the last.

THE CAUSE OF SUNSTROKE.—One of the difficulties in the way of the acclimatization of the white man in the tropics is sunstroke, which, according to district and season, plays greater or less havoc with white residents, and especially with white troops, in certain tropical countries. Every discovery that throws any light on the cause of sunstroke is especially welcome at the present time, when the "control of the tropics" is a subject of such paramount importance to so many nations. About two years ago the theory was advanced by Dr. Sambon that sunstroke is an infectious disease, and is due to the influence of a certain distinct microbe. This view, which was radically opposed to the ideas previously held on this subject, led to considerable discussion, but was not generally accepted. Recently Mr. E. H. Freeland, who, according to *Nature* (Aug. 23), has had exceptional opportunities of observing cases of sunstroke both ashore and afloat, shows, in the *Middlesex Hospital Journal* for July, that the older view as to the cause of sunstroke seems to him sufficiently to explain all the facts, and to be well supported by the evidence at hand. Mr. Freeland concludes as follows:

> "Whether sunstroke be due to external physical causes, or whether it be an infectious disease and due primarily to a micro-organism which has yet to be isolated,

must be decided in the future. For the present it seems to me that there is ample evidence for believing that sunstroke is due primarily to thermic influences—the exposure of the body to a hot, moisture-laden atmosphere—and, secondarily, to the circulation in the blood of certain toxic poisons, the result of perverted tissue metabolism; and that, until more tangible evidence is brought forward to prove that the affection is due to microbic influence, one may safely accept the older doctrine with regard to its causation as a sound working hypothesis, if nothing else."

THE WEST INDIAN HURRICANE OF SEPTEMBER 1–12, 1900.—The first scientific report upon the West Indian hurricane of last September, which will probably go down to history as the "Galveston Storm," has been published in the October number of the *National Geographic Magazine*, and was written by Prof. E. B. Garriott, of the Weather Bureau. The presence of a disturbance in the vicinity of the Windward Islands was indicated in the weather reports of the last days of August. During the first three days of September the hurricane moved west over the Caribbean Sea, and on the 4th, during the night, recurved northward over western central Cuba. On the morning of the 6th the centre had reached the southern portion of the peninsula of Florida. The path up to this time had been normal. During September 6 the hurricane made an abnormal curve to the westward, increasing in intensity and causing severe gales from the western Bahamas to Florida. Moving westward over the Gulf of Mexico, the storm centre reached the Texas coast late on the afternoon of September 8, and then recurved northward, passing directly over Galveston as a fully developed hurricane. The lowest barograph reading at Galveston was 28.53 inches at 8.10 P.M., when the centre passed over the city. The storm then advanced northward over Texas, Oklahoma and eastern Kansas, reaching Iowa on September 11. Here the dissolution of the disturbance seems to have been averted by the advance of a second cyclonic depression from the northwest, which strengthened the original storm. The further movement was to the eastward, over the Great Lakes, the St. Lawrence Valley and Newfoundland, there being a constant increase in intensity. The chief interest in this hurricane, apart from the terrible tragedy at Galveston, is the fact of the two sharp abnormal curves in the course of the storm—one over the Florida peninsula and the other on the Texas coast.

NOTES ON GEOGRAPHICAL EDUCATION.

BY

RICHARD E. DODGE.

THE SCHOOL OF GEOGRAPHY AT THE UNIVERSITY OF OXFORD.—The school of geography at the University of Oxford has entered upon its second year, with the same staff as last year, and a much more perfect plan of work. During the Michaelmas Term of 1900 regular lectures will be given by members of the staff on the following topics: The Historical Biography of the British Islands; the Development of Geographical Ideas; the Atmospheric Circulation; the Geographical Cycle; and the Geographical Development of the Roman Empire. Practical instruction in the laboratories will be given on four days in the week.

The examination for the diploma in geography, candidates for which must have studied in residence for one academic year, was held in June, 1900. The scope of the examination is indicated by the following outline:

> The figure of the earth and the determination of positions on its surface. The principles of surveying and of mapping. Map projections on the plane, the cylinder and the cone, and their commoner modifications. The reading, reduction, and generalization of maps, and the representation of climatic and statistical data. The methods of meteorological and hypsometrical observation.
>
> The configuration of the continents and of the bed of the ocean. The characteristics, history, and distribution of the chief land-forms, of the several types of mountain-systems, river courses and river basins, and of the coastal belt. The cartographical analysis of the forms, structures, and activities of the physical regions of the world.
>
> The distribution of solar energy on the rotating earth and the resulting circulations of air and water. The modifying effects of the distribution of land and water. The climatic provinces of the earth.
>
> The physical conditions of the oceanic areas and the methods of observing and representing them.
>
> The chief generalizations regarding the distribution of animals and plants.
>
> The geographical distribution of men according to number, race, and economic and political condition. The influence of physical features in determining the position of settlements and lines of communication.
>
> The outlines of historical geography considered in relation to the influence of physical features.
>
> The history of geographical ideas. The outlines of the history of discovery.

It will readily be seen that the opportunities at Oxford do not as yet rival the opportunities at certain of our American universities, though more attention is given to cartographic work and to historical geography than is common with us. It is to be hoped that the work may be increased in the near future, so that students may have a more elaborate course open to them. The scholarship of £60, open to students, is a favorable sign of the support that the school is receiving.

PHYSIOGRAPHY AT THE HARVARD SUMMER SCHOOL FOR CUBAN TEACHERS IN 1900.—It is probably well known in the educational and scientific world, both here and abroad, that Harvard University opened its doors during this last summer to more than 1,200 teachers brought from Cuba to take a six weeks' course at the University. Among the subjects selected for presentation to the teachers as a whole was physiography. Lectures were given to the entire body, followed by field excursions to places of particular interest in the vicinity of Boston. The lectures dealt with the simpler phases of the science, and were given, of course, in Spanish by Mr. Mark S. W. Jefferson, of the High School, Brockton, Mass. Mr. Jefferson was eminently qualified to conduct the work, not only because of his experience as a teacher and worker in physiography, but because of his training in Spanish gained through a residence of several years at Córdoba, Argentina, where he was engaged in scientific work. References in both the lecture and field work were made to Geikie's *Nociones de Geología* and *Nociones de Geografía Física.*

The excursions were twelve in number, the body of teachers being divided into groups so that each group had two trips a week. The excursions were to Medford, Mass., to study soil and rock weathering; to Beaver Brook, to study transportation; to the Cambridge Clay Banks, to study deposition; to Atlantic, to study marine deposition; to the Cambridge Slate Quarries, to study consolidation and elevation; to Hobbs Brook, to study valley carving; to Neponset Marshes, to study river deposition; to Riverside, to study terraces; to Nantasket, to study shore lines; to Clifton, to study ocean erosion; to Arlington Heights, for a general review; and to Melrose, for a review of differential erosion.

The University published a small pamphlet in reference to the excursion, with general directions in English and Spanish; general directions as to method of observation were given in an introduction, and under each excursion a series of leading questions was asked.

The success of the work was very great, and it is a great compliment to the science of physiography that this subject was selected by the Harvard planners of the school to represent the science group in the school work.

COMMERCIAL GEOGRAPHY FOR NEW YORK BUSINESS SCHOOLS.—The course in Commercial Geography outlined for the business schools of New York State by the University of the State of New York, in Bulletin 13, College Department, February, 1900, deserves more than a passing notice, because it is one of the first official publications along this line.

Ideas in reference to what should be included under the head of commercial geography are very varied, differing from the early training of the enthusiast. Publishers and teachers who are anxious to have commercial geography advance rapidly are, on the whole, uncertain of the best lines. Some believe that a commercial course should be "practical": that is, give the student an encyclopedic knowledge of the commercial possibilities of any particular area; others take the opposite position, that students should gain from the study of commercial geography not merely a series of facts connected in space only, but rather general laws and conceptions in reference to the controls of commerce the world over—in other words, that the course should be scientific rather than merely informational in character.

The course noted above belongs distinctly to the latter class, the commercial possibilities of the United States being apparently the key-thought. After a few introductory conceptions in reference to political and physical geography, the student is called on to make a careful study of the possibilities for internal commerce in the United States. Great Britain and her colonies and other countries are then considered with almost equal care.

The work is to be summarized by a study of the distribution of the more important commodities. In this section the causal idea is to be brought out in a general way. The following outline in reference to Turkey will illustrate the manner of treatment:

> TURKEY (including the Levant). Raisins, cotton, tobacco, attar of roses, carpets and rugs; wool and woollens, opium, licorice root, figs; international communications; chief city; two cities of Asia Minor.

It is to be hoped that the Departments of Commerce, already established by the University of the City of New York, and projected by Columbia University, may soon bring about a much-needed improvement in the commercial education of business schools, and especially in commercial geography.

THE BULLETIN OF THE AMERICAN BUREAU OF GEOGRAPHY, whose appearance was announced in this BULLETIN (XXXII, 1, 1900), has now gone through three numbers, and has won its place among the attractive helps for American geography teachers. In association with the Bureau is a Committee, which arranges to exchange products between different parts of the country. The most valuable work of the Bureau thus far seems to be in securing the possibility of purchasing valuable lantern-slides at a reasonable cost. Full particulars regarding the slides, with illustrations, will be found in the first and second numbers of the *Bulletin.*

The *Bulletin* has published a number of valuable articles, which have appeared with a pleasing typography and with many illustrations. The editor is to be congratulated upon his success, and it is to be hoped that some practical results of his work may be seen in our schools in the near future.

PHYSICAL GEOGRAPHY AS OUTLINED BY THE REGENTS OF THE UNIVERSITY OF NEW YORK.—The Academic Syllabus, issued by the Regents of the University of New York, has just passed through its semi-decade revision, and physical geography teaching has profited thereby. All teaching in the secondary schools of New York is largely determined by the demands of the Regents, as outlined in the syllabus, and hence those interested in special lines of educational progress welcome any advance secured each five years, because all schools concerned profit more or less thereby.

Pressure has been brought upon those in authority, within the last few years, to make the approved course in earth-science a progressive and continuous one-year course, with laboratory work. The Board has, however, outlined a twenty weeks' course in physical geography that may be followed by a twenty weeks' course in geology, thus making a one-year course in earth-science possible, though not of the strongest kind.

All geographers will not be able wholly to endorse the description of physical geography as outlined, and many will regret that the syllabus does not more strongly emphasize the necessity of a scientific and causal treatment, particularly because of the educational value of such work. The field of physical geography is outlined as follows:

"It takes up the causes that determine the configuration of land masses, the action of bodies of water, the various atmospheric phenomena, and the relations to each other of land, water and air. It also treats of geologic and astronomic relations, and deals with the physiographic influences on vegetable and animal life. It performs its highest mission, not in its treatment of inanimate nature or of soulless organisms, but in showing that the earth exists for man, and is of interest because it constitutes his physical environment. This syllabus regards the subject from the latter point of view, and does not attempt to require the solution of the problems that are studied in the other sciences."

A strong appeal is made for the encouragement of field work, especially in connection with the physiographic processes, and a weak suggestion is made that laboratory work is a possibility. It is greatly to be regretted that the Regents have not taken a strong stand in favor of definite laboratory courses in association with lecture and text-book work. A secondary course in physical geography cannot come up to the standard of a college entrance requirement until, like the other sciences, it is studied for at least a year with laboratory work.

The following are the larger topics suggested as belonging to physical geography: The earth as a planet; its motions and the effects thereof; distribution of land and water; the properties of air; climate; the phenomena of light; winds; storms; rainfall; the composition and motion of ocean waters; the forms of the land; islands; plains and plateaux; mountains and volcanoes; wasting of the land; rivers and river valleys; springs and lakes; glaciers; distribution of plants and animals; man and nature.

It may be said that the course is a composite of old and new ideas in reference to physical geography, and that, unfortunately, unsystematic physical geography seems to have the right of way.

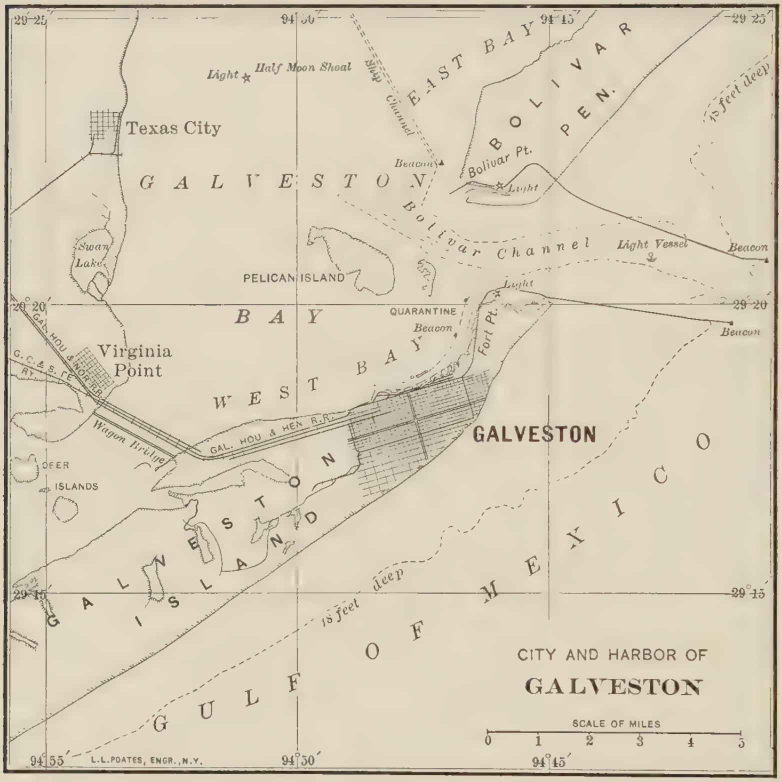
GEOGRAPHICAL RECORD.

THE UNITED STATES.

POSITION AND TRADE OF GALVESTON.—The harbors along the coast of Texas have little importance for international commerce, except Galveston and Sabine Pass. All the other indentations are too shallow to admit large vessels. Sabine Pass is at the extreme southeast corner of the State. The Government has spent large sums in improving the entrance to its land-locked lake, and its business in lumber shipments is now important. Its harbor is commodious and deep, but its disadvantages are that it is not so conveniently situated as Galveston for communications with the interior of the State, and, furthermore, the railroad system of Texas has been developed with Galveston in view as the natural geographical outlet by sea for the cotton, cattle, and other products of that region.

Galveston, nearly 300 miles west of the Mississippi delta, is centrally situated on the coast of the best-watered, most fertile and most populous part of Texas. The Brazos valley, the largest river basin in the State, and growing the best and most abundant crops of cotton, is directly tributary to it. There are four large railroad centres in Texas, from which lines radiate to all points of the compass, and these receiving points are all feeders of Galveston's commerce. These railroad centres are Dallas, surrounded by great areas of cotton and wheat lands; Fort Worth, the largest centre of the Texas cattle trade; Waco, which forwards much of the export cotton of the Brazos valley; and Houston, where 7,000 miles of railroads converge, and which has both rail and water communication with Galveston. Thus, without Galveston, the entire transportation system of the State, as developed, would be thrown into confusion. The advantages of Galveston's geographical position and its excellent harbor, and the consequent convergence upon the port of the inland freight routes which tap large agricultural and grazing regions, have made this city, in recent years, the second cotton port in the Union, and doubled her export business between 1892 and 1899. Last year Galveston was the fourth export port of the country, being surpassed only by New York, Boston and Baltimore.

Thus, while the development of Sabine Pass as a large seaport is mainly in the future, the necessity for Galveston had already been demonstrated and its development achieved before the terrible cyclone of September 8 nearly destroyed the city. The rebuilding of the port began as soon as possible after the calamity, not only because there is need for it, but also because there is no reason to believe that such a storm will ever again assail it; and, moreover, experts express confidence that engineering works may be provided that will prevent the recurrence of such a disaster.



This map shows the position of the port on Galveston Island, which is nothing but a sand barrier piled up by the waves during the past few centuries in front of the mainland. The island is over twenty-five miles long and from one to three and a half miles in width, and the city stands some two miles from its northeast end at Fort Point. The reëntrant known as Galveston Bay, formed by a number of flooded valleys, extends into the mainland for about thirty miles north of the city, but is everywhere too shallow for the use of the larger ships, except a comparatively small area at the entrance to the bay and along the water-front on the north side of the city. This field, however, is large enough to meet the needs of a great commerce, and is of sufficient depth to accommodate the largest modern vessels. Between this singular depression and the deep water of the neighboring sea, just in and outside the channel that forms the entrance to the harbor, is the usual fringe of shoal water; but it is only about two miles across. It is here that the Government has made improvements to facilitate entrance to the port. About $8,000,000 have been expended in building jetties, extending from Fort Point and Bolivar Point two miles gulfward. This large engineering work has been successful; the channel has been scoured through and a permanent deep-water passage secured from the Gulf into the Bay. Extensive dockage and warehouse facilities stood on the bay side of the city at the time of the cyclone, and others were building. Many wharves were injured only in parts of their superstructure. The map shows the three railroad bridges and the wagon bridge that connected the port with the mainland. All of them were swept away, and eight railroads have now combined to build for their purposes a double-track steel bridge, ten feet higher than the single-track bridges that were destroyed. It was found after the storm that the port itself was scarcely injured, and it has to-day a safe depth of twenty-seven feet.

The city extends across the island from the Bay to the Gulf, and its site is from six and a half to ten feet above mean tide-level. Earlier storms had given warnings, but they were not so serious as to create apprehensions that the city could be overwhelmed as it was on September 8. A storm thirty-three years ago caused the water to rise about six and one-half feet above mean tide, flooding the lower levels of the town. In the storm of 1875 the rise was a few inches higher; while in 1877, when the wind blew sixty miles an hour, the rise was only a little over five feet. In September last the wind exceeded a velocity of 100 miles an hour, but was chiefly important as the cause of the high seas that wrought most of the destruction. Galveston was in the vortex of the storm, and was simultaneously overwhelmed by waves both from the Gulf and the Bay. Still, many buildings on the higher levels escaped absolute destruction, while the ruin wrought on the lower levels was almost complete. A number of engineers have suggested plans for the future protection of the city; and it is not unlikely that a Commission will be appointed to agree upon the best means of safeguarding this important seaport.

San Diego as a Seaport.—Two years ago, San Diego, Cal., had practically no sea trade, while to-day ocean vessels are discharging merchandise there and loading with cotton and other products for the Orient. This is due to the improvements recently made in the port. The citizens have expended about $1,000,000 in wharves, and the Government is completing a jetty at the harbor entrance, by which means it is expected to scour out the sand and mud bottom, so that the largest vessels may enter at any time. As it is, the depth of water at the entrance is twenty-two and one-half feet at low tide, which is only two feet less than at San Francisco. Merchandise to the value of $2,631,599 was exported last year, which was more than ten times the value of the export trade in 1898. If the rate of exportation for the first quarter of this year is maintained throughout, the exports in 1900 will be at least $6,000,000. The imports grew from $142,108 in 1898 to $1,501,588 in 1899. The annual report of the San Diego Chamber of Commerce says it is expected there that the port, in a few years, will handle all the shipping trade of the southwest part of the country and an important share of the trans-continental trade. San Diego is connected with the Southern Pacific system as well as the coast lines of railroads; and as there is no practicable port for large shipping to the north till San Francisco is reached, it is greatly to be desired that the advantages of San Diego may prove adequate for the development of a large commerce.

Natural Gas.—The Twentieth Annual Report of the United States Geological Survey says that though natural gas in this country has been much reduced in quantity it bids fair to be a resource of considerable importance for years to come. The long-continued drain is felt in nearly all the fields long worked, but many companies are keeping up a full supply to their customers by extending their pipe-lines to new grounds. Thus the value of the natural gas produced in Ohio began to decline in 1892; but the decline was arrested in 1898, when the product was worth a third of a million dollars more than in 1897, owing to increased production in the Lancaster field, where new and vigorous wells were developed. In some districts, deeper drilling may tap new reservoirs, and discoveries are likely to be made in territory not yet adequately explored. Kansas, for example, has recently developed considerable new gas territory. The consumption of natural gas is now far more economical than in the early years of its use, as a given amount of effective work is now performed with less than one-half the quantity of gas that was required at the time of its introduction. The estimated value of the coal and wood which it displaced in 1898 was over $18,000,000. Its largest use is to supply heat and light for domestic purposes. It is found in many thousands of homes in the western parts of New York and Pennsylvania and in northern Indiana, north-western West Virginia, north-eastern and north-western Kentucky and south-eastern Kansas. It is also used for domestic purposes, to a smaller extent, in Texas, Utah, Colorado, California, Illinois and Missouri. Its use for industrial purposes did not include quite 1,200 establishments in 1898, and its restricted consumption in this field will, of course, tend to prolong the life of the gas wells.

NEW GOLD FINDS IN ALASKA.—Though the Koyukuk river and its tributaries are not yet thoroughly explored, mining prospectors have discovered mineral resources in that basin which promise to be of much value. The Koyukuk, about 700 miles in length, is one of the two largest northern tributaries of the Yukon. Its sources are not far from the Porcupine river, the other large tributary, and it flows to the west, north of the Yukon Hills, and then south, joining the Yukon about 400 miles from its mouth. Early in 1898 a few miners located pay-dirt on the gold belt that runs through the territory, about 600 miles up the Koyukuk. The reports, last fall, that they were doing finely, led to the departure of several hundred miners from the Klondike in the spring of this year. Consul J. C. McCook writes from Dawson that about 200 miners left that camp with pack horses and mules to take the overland trail from near Fort Yukon to the new fields; and another party started on a steamboat for the mouth of the Koyukuk, which they intended to ascend to the diggings. The whole region is reported to be rich in gold indications.

A Government party will sledge up the Koyukuk on the river ice early next spring. It will go to the Altenkakat tributary, about three-fourths of the way to the gold discoveries, and then strike north up that river and carry on explorations through the unknown northern part of Alaska to the coast of the Arctic Ocean. Supplies were cached, last summer, on the Altenkakat for the use of the exploring party next spring.

SURVEYS IN ALASKA.—It is doubtful if knowledge of any other part of the world has grown so rapidly in the past two years as that of Alaska. The Government surveys and explorations have been vigorously carried on in the past season. A Geological Survey party, under Mr. E. C. Barnard, has been making a topographical survey of the Seward Peninsula, the westernmost extension of Alaska, between Kotzebue and Norton Sounds. The Cape Nome gold district is on its south-west coast, and the newly discovered gold region of Cape York is on its north-west side. The map of this region is to be on the scale of four miles to the inch. Another party, under Mr. Alfred Brooks, studied the gold resources in the Cape York district, and another expedition, including Mr. W. J. Peters, topographer, and Mr. W. C. Mendenhall, geologist, went inland from Kotzebue Sound to trace southward the gold-bearing belt that seems to extend south-west across the peninsula, and is now being worked at its southern terminus on the sea. The Coast and Geodetic Survey also sent two steamers, the *Pathfinder* and the *Patterson*, to survey the entire coast from St. Michael to Cape York and Port Clarence, giving special attention to harbor facilities, if any exist. Thus five expeditions have been at work on Seward Peninsula and its coasts, and the result of this season's pioneering in this northern part of Alaska is expected to throw as much light upon that region as last year's surveys contributed to the knowledge of the more southern parts of the territory.

SOUTH AMERICA.

EXPLORATION IN THE NINETEENTH CENTURY.—Prof. Dr. W. Sievers, in his exhaustive article on geographical exploration in South America in the present century (*Petermanns Mitteilungen*, VI, 46 Bd., 1900), says that, up to 1875, no Government on that continent had sent out any expeditions or spent any money to explore the unknown parts of its territories. Nearly all the exploration of this century, excepting in Chile and Argentina, has been the result of private enterprise, mostly by European and North American explorers. Thus none of the Cordilleran States, from Venezuela to Chile, has, as yet, emerged from the stage of rough, pioneer exploration. A considerable portion of their territory, as in the south-eastern part of Colombia, is still almost wholly unknown. Some of them, like Bolivia, have made no attempt, except in small districts around their chief towns, to carry out official surveys. Conway, who recently passed through New York on his return to the Bolivian Cordilleras, is doing for Bolivia what other explorers, chiefly German, have done for the Ecuadorian ranges. Among the Atlantic States, the Guianas, except for a narrow strip along the coasts, are still on the threshold of exploration. Brazil has no establishment like our Geological or Coast and Geodetic Survey to make a scientific study of any part of its vast domain. All the official explorations in Brazil are the work of some of the individual States. Scarcely a traveller has crossed any of the north-eastern States, from Maranhão to Pernambuco; and much of the interior, except along the river courses, is still quite unknown. The wide wildernesses between the large tributaries of the Amazon are completely *terra incognita.*

In Argentina, however, very satisfactory progress in exploration has been made in the past quarter of a century. In 1882 the first collected results of the Government's activity in this direction were the large atlas of the country, prepared under the care of the geographer Seelstrang. Argentina has geological and meteorological establishments, and foreign scientific men in the service of the State and the Universities, whose labors have greatly enhanced the value of all official geographical work. The systematic study, which both Argentina and Chile have, for some years, given to the ranges along their common frontier, has made a large portion of this the best-known part of the South American Cordilleras. The reason why Africa, as a whole, is better known to-day than South America is because so many European nations, eager for foreign territorial acquisitions, have so zealously participated in its exploration; while in South America the poverty of the various States and their political disturbances have prevented them from contributing largely to the knowledge of their own continent. Thus there is more opportunity for pioneer exploration in South America than in any other continent, though the Spaniards crossed it from sea to sea over three centuries ago, and nearly every city on its coasts was founded in the era of the Columbian explorers.

THE HARBOR AT BUENOS AIRES.—The *Buenos Aires Herald* says that the Argentine Government has spent in twelve years nearly $50,000,000 in building a series of docks and basins for the accommodation of the shipping at that port. The mistake was made, however, of building a port without an adequate entrance to it. No preliminary study was given to the variable currents of the La Plata, nor any heed to the fact that enormous quantities of silt surcharge the river waters. Channels for the admittance of vessels were dug right across the currents, and they filled, or partly filled, with silt nearly as fast as they were dug. The result is that the approaches to the fine series of docks are lamentably inferior to their capacity and to the demands of commerce. The Government has now appointed an expert Commission to study all the conditions and report a practical plan for the construction of an enduring approach.

EUROPE.

Population of Sardinia and Sicily.—A. Cossu, who has made a study (*Riv. Geog. Ital.*, *Fasc. II.-III.*, 1898) of the distribution of the population of Sardinia in respect of distance from the sea, finds that since 1845 the population has been gradually increasing near the sea and decreasing inland. At an earlier period the malarial coasts and the attacks of pirates were strong influences driving population inland. At present, however, the density of population on the coast of the island is 46 to the square kilometer; from the coast to five kilometers inland, 34; and further inland, from 22 to 31. The steep and malarial coast facing Italy is for considerable distances almost uninhabited. This study recalls the investigation made by O. Marinelli in 1893 on the distribution of population in Sicily. He ascertained the fact that while the greatest density of the northern and eastern slopes is found on the coasts, that of the southern or African slope occurs entirely at a height above sea-level of over 1,300 feet. He attributed this fact to the influence of malaria and the unsettled state of the country in the Middle Ages, when the population was driven inland. In discussing these conclusions Dr. Theobald Fischer (*Petermanns Mitteilungen*, 1893, No. 8) expressed the opinion that the scanty population along the African coast is due still more to the natural characteristics of that coast, where the steep cliff of tertiary strata affords no natural harbors and where there were no suitable sites for strongholds to repel the attacks of pirates from the Barbary coast. Furthermore the rainfall is small, there is little level ground for cultivation, springs are scanty, and even the principal streams afford poor facilities for irrigation.

POLAR REGIONS.

The Duke of the Abruzzi returned to Tromsö in the *Stella Polare* on the 6th of September. His ship was fast in the ice for eleven months, and her sides were crushed by the pressure. She was pushed on the land, and four sledge parties were sent out to make explorations. One of these parties, composed of a Norwegian and two Italians, never returned. Another, led by Capt. Cagni, was gone 105 days, and reached the highest latitude yet recorded—86° 33′ N.

The general health of the party was good throughout the voyage and there was comparatively little suffering.

On the 11th of September the Duke arrived at Christiania and was received with the greatest enthusiasm. Nansen welcomed him on behalf of the University, and at night there was a grand torchlight procession.

LIEUT. AMDRUP'S GREENLAND EXPEDITION arrived at Copenhagen on the 4th of October. The party landed at Cape Dalton, 69° 25′ N., on the 19th of July, and Lieut. Amdrup mapped the coast to 67° 20′, the point at which the work ended in 1899. Dr. Hartz, at the same time, was employed in exploring and charting the coast to the northward as far as Scoresby Sound.

TWO ANDREE BUOYS have been discovered. One, marked No. 3, was picked up in the open sea, on the west coast of Iceland, on the 7th of July. When opened at Stockholm, in the presence of Nordenskiöld, Nathorst and others, it was found to be empty. The second buoy (No. 4) was reported from Skjervö, Norway, on the 31st of August. It contained a notice that it was thrown out at 10 P.M., on the 11th of July. At the time of writing the balloon was at an altitude of 250 metres (820 feet), and moving in the direction N. 10° East. A postscript adds that the direction had changed to N. 45° E., that the balloon was above very rugged ice, with splendid weather, and that four carrier pigeons had been released, and were flying west.

Andree made his ascent July 11, 1897.

CAPTAIN BAUENDAHL was to leave Hamburg in the middle of August on an expedition to the North Pole. He describes his plan in a communication dated July, 1900:

> There go with me a pilot, R. Dressler, and five seamen. The vessel is a deep-sea fishing boat, the *Matador*, of 44 tons. It has no engine. I propose to make for the pack-ice north of Spitzbergen and then to steer to the eastward till I come to open water or a channel which seems to offer a passage for the ship to the north. If I find the water, I shall push as far north as possible till the way is closed, when I shall leave the vessel perhaps, at the Seven Islands, and press on over the ice with the crew and the provisions. It depends upon the currents, the ice, the land and other conditions whether the return route shall be by way of Franz Josef Land, or Greenland, or in some other direction.
>
> My reasons for choosing my route and method are that previous attempts to reach the Pole in ships have been frustrated by the masses of ice or, when open water invited advance, by the dread of risking the vessel and the desire to keep it for a base. So far as I know, no one has yet pushed his ship into the pack-ice northeast of Spitzbergen. Parry in 1827 found himself north of Spitzbergen, where, owing to the encounter of the Gulf Stream with the Polar current, the wall of ice seems to be especially compact. It appears to me that, more to the eastward, the conditions may be such as to afford an opportunity for progress with a ship.
>
> Should we find ourselves compelled to take to the ice, we know from the examples of the *Hansa* and the *Polaris* that men can travel over the ice-field if they have sufficient food and fuel. I carry enough of these for two years—a weight, that is, of about 200 hundred weight—to drag with us at first; but I hope to make my way even over rough ground and to obtain at the same time scientific geographical results.

Whatever Capt. Bauendahl may do in the Arctic, his success in finding six men to help him pull a load of ten tons to the North Pole is a remarkable feat, and all must wish him and them a safe deliverance from a ship with such an evil name as *Matador*.

Mr. William Ziegler, of New York, proposes to fit out and dispatch an expedition to the North Pole in the summer of 1901. There will be two ships, and the leader of the expedition will be Mr. Evelyn B. Baldwin, who was with Peary in Greenland in 1893, and a member of the Walter Wellman party in Franz Josef Land in 1898–99.

Mr. Baldwin has been attached to the U. S. Weather Bureau.

The Berlin correspondent of the London *Standard* gives some details of the construction of the ship for the German Antarctic Expedition. It is a wooden, three-masted schooner, with strong ribs, and triple woodwork of oak, pitch pine, and greenheart, for protection against the ice pressure. It is hoped by this means to obtain sufficient strength without adopting the peculiar form of the *Fram*. The ship will have a triple-expansion engine capable of an average speed of seven knots. The space under the forecastle will be prepared for about fifty draught dogs. All the available space will be turned into coal-bunkers. Besides five ordinary boats an oak naphtha-boat will be taken, six metres long and two broad, and capable of holding fourteen to twenty persons, or 2,500 kilograms. The engine, of four horse-power, will give the boat a speed of from four to five knots. A captive balloon, with the necessary filling apparatus and a searchlight apparatus, will be taken; also a windmill for the working of the dynamo-engine, when the boiler is not under steam. Termination Island, geographically still little known, will probably form the first objective point of the expedition.

GEOGRAPHICAL RELIEF MAPS: THEIR USE AND MANUFACTURE.

BY

COSMOS MINDELEFF.

Geographical and topographical maps in relief have not attained the use which their advantages merit. This is due, not to any lack of appreciation of the system—for opinion on that point is practically unanimous—but to a variety of causes, prominent among which may be mentioned the high first cost of such work, and, in a lesser degree, a prevailing impression that any one can make a relief map. Such an impression invariably leads to disappointment, and the system is condemned when the fault lies only with the workmanship. A relief map is essentially a portrait, and we can no more expect good work from a novice in that line than in any other line of portraiture—sculpture or painting, for example. In either case the workman must have a definite and clear conception of the final result for which he strives; otherwise his work will be worthless. Another element which has had some bearing on the problem of the wider use of relief maps is a disposition on the part of those for whom they are usually made, generally scientific men, to look more closely after the manner of making than after the result—an apotheosis of method, as it were: not an uncommon failing in other branches of scientific work. None of these tendencies, however, seems insuperable.

Concerning the advantages of relief maps over other methods of picturing a section of country there is little difference of opinion. Contrary to the usual experience, on this point experts—that is to say, scientific men—and laymen are in full accord. In a letter received by the author from Prof. John Tyndall a short time before the latter's death, the great authority on physical geography said:

> From your photographs and photo-engravings a better idea of the general aspects of a country is to be obtained than from much reading.

This statement was made with reference to a series of sketch maps of the grand divisions of the earth, made for use in a text-book of geography for school use. A reproduction of one of the models—South America—is presented with this paper.

Mr. Charles D. Walcott, the present director of the United States

architect received a commission to improve a cemetery plot, but in working out his plans he encountered two difficulties which seemed insuperable. One was to select the exact thickness and height for a series of sloping walls which would bring them in harmony with the site, and the other was so to plan certain low structures, essential to the project, that they would not come into conflict with the cemetery regulations. He struggled with these problems for some time without making any progress until finally he decided to have a model made. A little relief map, hardly one foot square, removed all the difficulties. It was made to represent, first, the plot as it was; then it was graded and terraced and miniature representations of the walls were put in place, various thicknesses and slopes being tried one after another until the most satisfactory one was found, and finally the model showed the plot as it would be when the improvement was completed. The final model was submitted to the trustees of the cemetery as an exact picture of the plot as it would be, and was accepted by them, although the plans had been rejected previously. The architect then had merely to turn over to his draughtsmen the relief map, which was made very closely to scale, and the working drawings for the grading, stone-cutting and all the other details were made from it. At the same time objections which had been made by neighboring owners, who had believed that their plots would be badly affected by the proposed improvements, were withdrawn at once after an inspection of the little model.

Perhaps the most important use of relief maps is in educational work, although this is only a variation of the general problem, which is to convey an adequate and truthful representation of a section of country to those who have no knowledge of it. For this purpose the model is obviously superior to all other methods, for the simple reason that a relief map is an actual picture, while all other maps are more or less conventional representations, requiring more or less technical knowledge to understand them. An ideal system of teaching geography in schools by the aid of models would not be difficult to devise. Such teaching should proceed from the concrete to the abstract, and should begin with a thorough study of some small area convenient of access. Some well-known hill near-by, or part of one of the city parks, could be modelled on a large scale, and after the scholars became thoroughly familiar with the relief map they could be taken out and introduced to the region itself, if necessary comparing it with the model on the ground. Then the same region could be depicted on maps of various kinds and on different scales, a thorough study of which, in conjunction with the knowledge already acquired, would give the students a fair idea of what maps mean. Subsequently their mental horizon could be enlarged gradually by the use of models and maps of larger areas—first a county, then a state, afterwards the country as a whole and, finally, a continent. From his personal knowledge of parts the student would retain a lively interest in the whole, and the study of geography would change from its present "dry-as-dust" character to one of the most absorbing subjects in the curriculum. The plan of map-modelling in clay or putty, which is practised in some of the public schools, bears no resemblance to the system sketched above, since it lacks the essential feature of personal interest and personal knowledge of the region depicted.

The ability to read a map—that is, to obtain from a study of it an adequate mental conception of the country depicted—is much more rare than is commonly supposed. The writer has often made the statement that not one person in a thousand understands a contoured map, and he has never been contradicted. On the contrary, one of the best-known geographers in the country, who has supervised the making of hundreds of such maps, said on one occasion that one in ten thousand would be nearer the true figure. Yet with the modern tendency of map-making to the almost exclusive use of the contour system, such knowledge becomes more and more necessary every year. Any project of instruction, therefore, which promises to impart it is worth consideration.

Of the many methods of showing on a map the relief of a country but three have attained any vogue. These are: by hachures, by contours, and by relief maps. In the hachured system relief is shown by shading, more or less conventionalized, the effect being secured by small broken lines. In the majority of examples—indeed, in nine-tenths of the maps of this kind one sees—the system has degenerated into a purely conventional one, the graphic value of the method being lost sight of entirely, and the relief is shown merely by a few pen scratches, with little or no effort to differentiate the kinds of relief. Of such character are most of the maps seen in books as illustrations, of which the best that can be said is that they indicate that there are mountains in the country. In the best examples of hachured work—of which, perhaps, the Dufour maps of the Alps are the most perfect illustration—an attempt is made to represent the country as it would actually appear under given conditions of lighting; that is to say, with the light coming from a certain direction and at a predetermined angle. Obviously this method is an approximation to the relief map; but the result is not nearly so satisfactory, since its tendency is to exaggerate the minor elements of the relief at the expense of the main features. Moreover, it substitutes an artificial for a natural scale of shadows, and in practice there is no way to distinguish between a mountain 5,000 feet high and one of twice that height. Further, a mountain which rises 500 feet above a plain must be a less pronounced feature on such a map than one which has a height of 1,500, although the former might have an elevation of 12,000 feet above sea-level and the latter only 2,000. In other words, the principal characteristic of hachured work, in its best examples, is to bring out the details of the relief while sacrificing the main features. But the relief map brings out that detail in a much better way, and with a much more natural effect, while preserving the relative relief.

On the other hand, contoured maps sacrifice the graphic element almost entirely in order to exhibit the relative relief. The face of the country is shown by a series of continuous lines, each of which is equidistant, throughout its entire length, from sea-level or some assumed base. Looked at superficially, it would appear that any one should be able to understand a system so simple, for all that is necessary to determine whether one point is higher than another, and how much higher, is to look at the contours. As a matter of fact, however, the system is so purely a conventional one that even long training and much experience do not enable one to determine the character of the relief, although any child could ascertain its amount. So far as it goes, the information such a map gives is clear and definite; and it is doubtless on this account that contours have largely superseded hachures as a means of showing relief on maps. Shading by hachures is now so little used that it may be said, in a general way, that maps made on that system indicate principally a lack of data. When a map-maker does not know whether a certain mountain chain is 1,000 or 10,000 feet high, or whether it is ten miles or a hundred miles long, and has no idea whatever of its width, he naturally prefers to indicate it by a few pen lines, which might mean one or the other of these things. The contour method is essentially a system of quantity of relief, and succeeds in showing that, but at the expense of quality or character.

On contoured maps made on a large scale, with contours of small interval, the lines have some graphic value, as when placed closely together they produce a kind of shading, but usually they serve to show only the relative relief. In a general way it may be said that the hachured system is a qualitative one with a quantitative element, while the contoured system is a quantitative one with a qualitative element. Relief maps are more graphic than hachures, and surpass contours in showing the relative elevations.

For engineering work, and for many other technical uses where quantity of relief is the main desideratum, contoured maps fill the requirements and are superior to any other. But for general use the system falls far short of being perfect. Similarly, where quality of relief is more important than quantity—as, for example, for the use of the army—hachured maps are more serviceable. The most ambitious work of this character in this country was the War Department survey of the region west of the 100th meridian, designed primarily for the use of the army. That work was discontinued some twenty years ago, and was never resumed, as the present Geological Survey, using the contoured system, replaced it.

In the element of clearness—not the least essential in maps—contoured work has a very decided advantage, since the relief is shown without obscuring other details, such as lettering, drainage, culture, etc. Indeed, in this respect it is much superior to relief maps, the graphic qualities of which are much lessened by the addition of other data. Still, if the model is made with reference to the use to which it is to be put, this disadvantage can be overcome to a large extent, if one bears in mind that strong lines of any kind, other than drainage, have a tendency to destroy relative relief.

Modelling as a method of showing relief should be considered as an elaboration rather than as a rival of the other methods, for in the making of a relief map the first essential is a good hachured or contoured map. The principal use of models must be, therefore, in those cases where the best results are desired, irrespective of comparative cost. Relief maps require a large amount of minute and painstaking labor, of the highly skilled variety, and are, therefore, expensive. The cost per square foot covers a wide range—from $5 to $50—and, to a large extent, is under control, for it depends principally on the character of the work, the purpose for which it is done, and the degree of accuracy which is demanded. A sketch model of a large area on a small scale does not require one-tenth of the time and labor demanded by a relief map of the same area made closely to scale and of the highest degree of accuracy; that is to say, as accurate as the map from which it is made. On such models a day's work might not be more than a section measuring two by three inches, requiring three weeks to the square foot; while in a sketch map, where the permissible error is large, the workman could average over a square foot each day.

Aside from manual skill the prime requisites in the equipment of a good modeller are a thorough knowledge of topographic form, a wide familiarity with maps and the ability to read them, and a specific knowledge of the region to be modelled; or, failing that, he must possess at least a clear conception of what he seeks to show. Perhaps the best training for a modeller is the actual work of surveying in the field, and the drawing of maps from the instrumental data thus secured. It is hardly reasonable to expect good modelling work from a person who has never seen a mountain chain, and whose knowledge of maps is limited to what can be learned from the printed product; yet many relief maps have been made by such persons. It is not surprising, therefore, that topographic models are not always satisfactory.

The modeller must be an artist as well as a topographer—which is, by the way, rather a rare combination. He must not only know topographic forms, but must have a feeling for them and the ability to give expression to that feeling in a material medium. Theoretically, the topographer without artistic feeling should be able to make a better relief map than the artist without topographic knowledge, for he would know at least what he wanted to do. Practically, however, the artist succeeds better than the topographer, for his trained imagination partly supplies what he lacks, and enables him to form a mental picture of the whole, which it is not difficult for him to incorporate in clay or wax; while in the surveyor's mind there is nothing but an aggregate of detail. Artists differ widely, however, and in many instances it is a case of "all maps look alike to me."

Given an expert modeller and a good contoured map, the procedure of relief map-making is simple. If all the topographic data on the map are to be used, as many copies are made as there are contours: if the maximum elevation is 1,000 feet, for example, and the interval is 100 feet, there would be ten copies. Upon a baseboard representing sea-level, or some other assumed base, one of the maps is mounted, and the others are pasted upon thin wood or cardboard of the exact thickness required by the vertical interval; in the example cited, with a vertical scale of 1,000 feet to an inch, each contour would be one-tenth of an inch. Each cardboard is then placed under a scroll saw, which follows the contour line, all that portion below that level being rejected. Thus the first contour sawed out shows nothing below the 100-foot level but everything above it, including the 200-foot line; the second contour shows nothing below the 200-foot level; and so on. It is then a simple matter to tack the second contour on the first, since its edge is the same as the 200-foot line, and to continue the process until all the raised contours are in place. At this stage the model should be an exact copy of the contoured map, but with the contours in relief, rising in a series of steps or terraces from sea-level, or the base, to the highest mountain summit. In some instances the model is not carried beyond this stage, but usually this is merely the base upon which the modelling is done.

Up to this point the work is mechanical and can be done by any ordinarily careful person; no knowledge of topography nor skill is required. In the next step, however, these qualities come prominently to the front. Upon the raised contours as a base the modeller fills in the topography with clay or wax, or whatever medium he employs, converting the conventional map into a lifelike representation of the country. Ordinarily he has no other data than the map upon which he works; but if he is competent that is sufficient. Every minute variation in the trend of a contour line and every change in its relations to the lines below and above it mean something; the modeller knows exactly what that meaning is and is able to incorporate it in the wax. He cannot go far wrong, for the contour interval is small—often, indeed, minute; ordinarily less than one-fifth of an inch, and often not more than one-fiftieth.

In other words, to the modeller the raised contoured map is merely a means of control, occupying much the same relation to the finished work that the primary and secondary triangulation do to the map. To fill in the raised contours by connecting their edges by slopes, and calling the result a relief map, is almost as senseless as it would be to fill in the region between the primary triangulation points on the map with straight lines; yet it is often done. The modeller should be able to look through the map and see what the surveyor saw; he must undo the generalizing that was done, and supply the detail which is necessarily omitted in the map or so slightly indicated that it is apparent only on close study. Unless he does this the relief map he makes will be "wooden" and lifeless, and will not be a true representation of the country.

Where the object sought is a graphic representation of a region, accuracy of detail, while important, is not so essential as that broader truthfulness which shows the country as it is, or rather as it appears to be. The point can be illustrated by a reference to the celebrated Muybridge series of photographs of moving animals, which made a sensation many years ago when they were brought out. It was shown, for example, that all the drawings ever made of horses galloping were entirely erroneous; that at no time in the

movement did the horse's feet take the positions shown in the drawings. Thereupon some artists adopted the facts thus determined, using them in their work; but the result was so grotesque that the plan was soon abandoned for a return to the old methods, which showed galloping horses as they appeared and not as they are. Similarly, the difference between a good model and a bad one is the difference between a portrait and a photograph—one shows character, the other exhibits only detail. Where detail is the main desideratum the problem is not so difficult.

When the model is to be reproduced by photography, however, the graphic feature is the dominating element, and the enormous reduction which the model suffers is more than sufficient, usually, to eliminate the result of any liberties that may have been taken with the scale. With a contour interval of one-twentieth of an inch—which is larger than ordinary—only a very careless modeller would run off his scale as much as a contour and a half, even in a sketch model. This would mean about one-fifteenth of an inch on the model, or less than one-fiftieth of an inch on the photograph, with the ordinary reduction; less, usually, than the permissible error on the original map from which the model was made. It will be seen, therefore, that the question of accuracy of detail has been given an undue prominence, and, unfortunately, at the cost of truthful representation in its broader terms. It is so much easier to make an accurate model than to make a relief map that is really a portrait that the former is much more common than the latter.

Another problem closely related to the foregoing is the amount of exaggeration to be given the vertical scale—and on its proper determination depends, to a large degree, the success or failure of the work. Theoretically, a truthful model would have no exaggeration; practically, in very many cases, such a model would show so little that it would be worthless. Unfortunately, the matter of relative vertical scale has been the subject of bitter controversy—principally among scientific men, not among modellers. The latter should know best what is required, and the determination should be left to them, if they are competent. In a general way the scientific man advocates too little exaggeration and the modeller too much.

One well-known chief of a State survey went to the extent of declaring some years ago that, "He that will exaggerate the vertical scale of anything will lie." On the other hand, it is obvious that he who attempts to make a small-scale model of a large area without vertical exaggeration lacks sense. A relief map of the United States, for example, 30 inches long, would have a vertical scale of over 500,000 feet to an inch; the maximum relief would be about one-thirtieth of an inch, and the general relief in the mountainous districts less than one-fiftieth. In other words, for all practical purposes, there would be no relief at all; the result would not be a relief map. Models have been made, however, in which the mountain peaks looked like church steeples, and a chain of them had the appearance of the teeth of a saw.

One of the principal effects, or defects, of vertical exaggeration is to diminish the apparent size of the region shown. As the relative height of the mountains is increased, the comparative width of the valleys is necessarily diminished. Few persons would realize from a study of a relief map of California, or of any other kind of map, that to the traveller the great valley of that State presents much the same appearance as the plains of Kansas; yet with a proper selection of scales that effect can be suggested in a relief map, if not actually shown.

Where the result desired is a pictorial one—that is, where a graphic representation of the country is wanted—it is the absolute and not the proportionate relief which is important. Whether the horizontal and vertical scales are as 1 to 2, or as 1 to 20, is immaterial. In the sketch map of South America, made for reproduction by photo-engraving in a much-reduced scale, the vertical exaggeration is 25. That would be absurd if applied to other subjects made for other purposes, but in this case the result was satisfactory. On the model itself, which measured about three feet in length, the absolute relief was about three-quarters of an inch, although it looked to be double that. In a general way that amount —from one-half to three-quarters of an inch—may be taken as the proper amount of relief for a model of that character, although in some cases it can be made smaller with advantage.

As an illustration of the scanty knowledge on this subject which is possessed by men who are ordinarily well informed, reference may be made to a bill introduced a few years ago in Congress, providing for the construction of a huge relief map of the United States on one of the public reservations in Washington, close to the Washington Monument. The measure provided for a scale of a square yard to a square mile, which would make three feet to a mile. The amount of ground surface to be modelled would be over 51,000,000 square feet, which, even at 10 cents a foot, instead of $30, which is a fair average price, would cost $5,000,000. The model would be over a mile and a half long and over a mile wide. Without vertical exaggeration, the highest mountains would rise

about nine feet above the base, while in the eastern part of the model the greatest height would be less than three feet. That amount would be hardly perceptible in a subject a mile and a half long, although, theoretically, in a model of such large scale no vertical exaggeration should be necessary.

Models of large areas are sometimes made on a curved base, representing a section of the earth's surface. This would doubtless be regarded as essential in such a model as that proposed. The actual curvature of that section of the earth covered by the United States is about 480 miles. Were the proposed model made without vertical exaggeration it would have to be bulged, or rise from the flat, on the scale proposed, 1,440 feet—almost three times the height of the Washington Monument, near-by. With such vertical exaggeration as would be necessary to bring out the relief, the curvature of the model would be very much greater. As a matter of fact, a model 100 feet in diameter would express much more than the vast work proposed, and its cost would be only a minute fraction.

The ability or skill of the modeller is an important element. A good workman can show relief and character in much less space than a poor one finds necessary. A vertical scale of 40,000 feet to an inch, allowing one-fortieth of an inch to each contour interval of 1,000 feet, seems very small, yet it is sufficient to bring out the main features in a small-scale model of a large area. One-fiftieth of an inch can be shown readily, and where the features are well marked, one-sixtieth. On the other hand, in a large-scale model of a region in which the topographic features are not strongly marked—a rolling country, for example—a difference of one-twentieth of an inch is hardly perceptible. It is impossible, therefore, to make any general rule as to the proportion of scales, or even as to the absolute relief required to secure the best result. Each case must be considered and decided by itself.

After the surface of the relief map has been modelled in wax or other material, the further steps in the process depend on the purpose of the work. If designed for photographic reproduction, all that is necessary is to paint the model white, with the drainage and water surfaces in blue. This can be done as well on the wax surface as on a plaster reproduction; and the effect is more satisfactory, for in moulding and casting some of the fine detail is necessarily lost. Indeed, the slight roughness of the wax surface which comes from tooling adds materially to the effect and should be preserved if possible; while the clean, sharp edges of the original work, which add much to its expressiveness, can be retained only by making the photograph from the wax. The original model, if properly made, is, for all practical purposes, as permanent as a plaster cast, and where only one copy is wanted, is in every respect preferable.

The photographing of models is an art in itself, and many professional photographers fail to secure good results through inability to manipulate the lighting properly. A white-painted model is extremely sensitive to slight changes in the amount and direction of the light, and small variations in these elements make pronounced differences, not only in the general appearance of the model, but also in the amount of the relief shown. In a general way the more oblique the light the more pronounced the relief; yet if the angle be made too small all the detail in the heavy shadows will be lost. This difficulty can be obviated by the use of reflecting screens to light the shadows, as is done in portrait photography. Only by numerous experiments can the best conditions be determined, and those conditions necessarily vary with each subject.

The preparation of the model for photographing is an important preliminary, which has not always received the attention it should have. If the surface is glossy there will be numerous local reflections which will "kill" the relief as effectually as bad lighting; the best finish is that known among painters as an egg-shell gloss. Furthermore, while the model should be white, it should not be a pure white, since in that case the contrast between the high lights and the deep shadows in the photograph is too pronounced. A very slight tinge of yellow—so slight as to be imperceptible to the eye unless compared with a white surface—gives the best result. But these problems are technical ones; enough has been said to show that skill and experience are as necessary in making the photograph as in the earlier stages of the work. The point which it is sought to illustrate is, that with skill and care better results can be secured with relief maps than in any other way, but that competence, knowledge, and attention to detail are essential to success.

As no satisfactory method of duplicating relief maps at small cost has yet been developed, the only available means of reproducing such work that is practicable is by photographic processes. A model, the first cost of which is perhaps $500, and duplicates of which could hardly be made for less than $100 each, could be reproduced by photo-engraving, and if the edition is large enough the maps could be sold at a profit at five cents each. As such relief maps are immensely superior for many purposes to other kinds of maps which cost more to print than the amount stated, since they are usually in two or three colors, there is no apparent reason why photo-engravings of models should not in time supplant the other methods for many purposes. One thing that has militated against such development is that most of the work done so far has been by amateurs. Should the demand become large enough a class of specialists would be developed, and much better results could be looked for. That such demand will arise eventually seems probable, since there is a consensus of opinion among scientific men and laymen as to the value of relief maps, and none of the difficulties in the way of good results is such that it cannot be overcome by skill and knowledge. One relief map should not be expected to serve two or three conflicting purposes, but the work should be done with especial reference to the end sought, and to that end only. Methods should be subordinated and more attention given to the finished product. In certain classes of scientific work, where the method employed is important, the modeller could be required to state his procedure, as the chemist does. But relief maps should be regarded as artistic and not as scientific products.

It must not be inferred from the absence of descriptions in this article of methods of constructing relief maps, other than by sawing out and building up the contours, that the method given is the only one. On the contrary, their name is legion, and indeed every new piece of work presents problems of its own which must be solved as it progresses. Several pages might be devoted to descriptions of different ways in which models have been made, but the question is purely a technical one. The three relief maps used to illustrate this article were made by three different methods. In the case of South America, concerning which general data are fairly good but detailed geographic information is lacking, contours of various interval were used in the base and the modelling was done with a free hand, with especial reference to a photographic reduction from three feet to less than ten inches. In the map of Alaska, where data are very scanty, the map was mounted on a base board, pins were driven at all points where elevations are known, mostly mountain peaks, and all the intervening region was filled in from the hachured map, most of the information on which was derived from description. In the model of northeastern Iowa the topography, which is of an entirely different character from both of the preceding, was modelled over a carefully made contoured base, and was finished under the personal inspection of a geologist who was familiar with almost every foot of the ground. The scale also was much larger and the vertical exaggeration less. This model is much more accurate than the other two, but is not so expressive—partly, perhaps, because the region depicted is a rolling or hilly country and not a mountainous one.

LETTER OF M. HENRI FROIDEVAUX.

GEOGRAPHY AT THE UNIVERSAL EXPOSITION IN 1900.—Various writers have attempted to describe the inexhaustible mine of geographical information in the present Exposition, but none have succeeded better than MM. Emmanuel de Margerie and Louis Raveneau. Whoever wishes to study the cartographical portion of the Exposition must read in the *Annales de Géographie* the work of these gentlemen on "Cartography at the Universal Exposition in 1900." It will there be seen that Class 14 of Group III (Maps and Apparatus of Geography and Cosmography. Topography) is far from embracing all the maps at the Exposition.

None the less this Class 14 contains numerous and most interesting documents: the remarkable series of maps of Corsica, exhibited by Prince Roland Bonaparte, which reveal in all its details the cartographical history of the island; the collection of plans of Paris formed by M. Mareuse, and the original notes of cartographers and explorers from the archives of the Société de Géographie, especially attract attention in the historical section (together with an admirable terrestrial globe of the Mercator school, in silver-gilt, belonging to M. le Provost de Launay). To this should be joined, in Class 15, some most interesting old instruments, formerly employed by the geographical engineers during the campaigns of the First Empire, and later by the Officers of the General Staff, for their astronomical and geodetical operations and for topographical surveys.

Extremely interesting, also, are some relief maps exhibited by the Geographical Service of the Army and also by the house of Hachette, whose geographical work is so admirably directed by M. Schrader. Other remarkable reliefs are those of M. J. Chardon (France 1 : 200,000) and M. C. H. Perron (Switzerland, according to the terrestrial curve, on a scale of 1 :100,000). These prove in the clearest manner that even on a small scale it is by no means necessary to exaggerate elevations. Worthy of mention also are M. Imfeld's relief (the Bernese Alps, on a scale of 1 : 25,000; Mont Cervin at 1 : 5,000) and others showing parts of the Swiss territory, the work of M. F. Becker, M. S. Simon and M. A Heim. Very remarkable, also, are the relief map of the Semmering railway exhibited in the Austrian group, and that of the Yellowstone National Park, the work of Mr. Edwin E.

Howell, who exhibits also a geographico-historical relief of the Island of Manhattan. Very instructive reliefs are those of the State of California by George C. Richards and George Starb; of the Seine Maritime (elevation exaggerated three times) by M. Muret; of Algeria, by M. Molinier-Violle; of Madagascar by M. J. Hansen; and of New Caledonia by Commandant Laporte.

Attention must be called to the hydrographic atlases of the Mekong and of the Niger by the distinguished explorers Simon, Mazeran and Hourst, and to the maps, both printed and manuscript, of many countries (Germany, Austria, Denmark, Japan, the United States, etc.) illustrating the river systems, the mineralogy, the industrial or agricultural resources. From this point of view Russia especially calls for notice; her pedologic exhibition (*pedology* is the name given to the study of the soils) is in every way remarkable, and shows the importance of the science which was in its infancy at the Exposition of 1889. The collection of maps, books and specimens of every kind assembled in Group VII is full of instruction in its patient and minute analysis of the Russian soil as displayed in the fine map on the scale of 1: 2,520,000 by MM. Sibirtzeff, Tanfilieff and Ferkhmine.

A cartographical work of great importance, still in process of completion, is M. Julien Thoulet's lithologic map of the French coasts. The portion exhibited contains twelve maps, which show the character of the soundings along the shore from the bay of Isigny to the estuary of the Gironde.

Mention must be made also of the photographic collections illustrating the forms of the surface, the meteorology, the flora and fauna, the anthropology and the ethnography of all parts of the world, without omitting the extremely fine photographs of clouds, made in the United States by Messrs. A. J. Henry and A. McAdie, and in France by M. Alfred Angot, and the interesting exhibit of the Club Alpin. Of mountain photographs none is more magnificent than Vittorio Sella's Mt. St. Elias.

Not the least impressive among these endless collections are the photographs of Algeria—veritable topographic documents—which bring out the intensity of the erosion in this country, where sudden and violent downpours of water follow on long drouths, and the vegetation is too sparse to afford serious protection to the soil.

Of the panoramas exhibited unusual interest attaches to that of the Trans-Siberian Railway, executed in the most conscientious manner by Dr. Piassetski, and the superb panorama of Mont Blanc, by M. Fr. Schrader. The point of view in the latter is from the glacier des Périades, on the side of the Tacul, at an elevation of more than 9,000 feet.

In the Canadian exhibit, the mineral riches of the Dominion are displayed as far as possible in the order of the Provinces, the place of honor naturally falling to the gold region of the Klondike. Other auriferous countries display their wealth; West Australia leading the way with an exhibit of gold nuggets to the value of more than 500,000 dollars. But the most complete mineral exhibit, without question, is the systematic collection of the minerals of the United States, according to Dana's classification, brought together by the combined efforts of eight universities.

In the midst of the crowds and the excitement of the Exposition the return of M. Fernand Foureau passed almost without notice, and there were few persons at the Lyons station to greet the explorer, who had just crossed the Sahara from the south of Algeria to Lake Tchad, and had returned to France by way of the Gulf of Guinea. In a future letter, after hearing M. Foureau's report to the Société de Géographie, I shall set down the principal scientific results of his journey.

Here it is interesting to record that the "Military Territory of the Countries and Protectorates of the Tchad" has received a definitive organization. It is constituted by the basins of the Kemo and the Shari; it begins on the Ubanghi, at the confluence of the Kemo with the great affluent of the Congo, and it is bounded on the north by the shores of Lake Tchad. From Goulfeï to Fort Archambault, along the line of defence of the Shari, will be stationed the infantry charged with the protection of the Territory, while it is proposed to quarter the cavalry and artillery at Massenia.

A treaty, recently signed, puts an end to the questions of boundary which had arisen between Spain and France in Africa. In the Western Sahara, France keeps the Adrar and the Sebkha d'Idjil, and this disposes of the question of the Rio de Oro; while to the north of the French Congo, France reserves a right of preëmption on the Spanish territory, comprised between the German frontier of the Kamerun and a line drawn from the mouth of the River Muni to the ninth degree of longitude, west from Paris.

Of geographical publications in these recent months there is not much to note, but I must mention the second volume of the French translation of Suess's *Das Antlitz der Erde*, executed under the direction of M. Emm. de Margerie, with a conscientious care that cannot be too highly praised.

The Ministry of Public Instruction has issued the account of the travels of Captain Cupet in Laos, and among the savages of south-eastern Indo-China. This work forms Vol. III. of the section "Géographie et Voyages" in the series of the Pavie mission. It is very attractive, and is accompanied by excellent maps.

A special place must be reserved for the work of Mgr. Alph. Favier, Vicar Apostolic of Peking, on that great city. In this volume, which bears the title: *Péking. Histoire et Description*, the eminent author gives a most interesting account of the history and the life of the capital of the vast Asiatic empire, under its every aspect, and has produced a work to be read and to be kept for its permanent value.

Paris, September, 1900.

NOTES AND NEWS.

The U. S. Geological Survey has published Water-Supply Papers, Nos. 35 to 39, giving results of measurements of rivers and observations of height.

No. 35 is devoted to the rivers flowing into the Atlantic, from Maine to Virginia.

No. 36 to the rivers flowing into the Atlantic, south of Virginia.

No. 37 to the rivers flowing from the eastern Rocky Mountain area.

No. 38 to the rivers tributary to the Colorado, the Interior Basin and the Columbia River.

No. 39 to the California rivers, and to the rating tables for various river stations described in Nos. 35 to 39, inclusive.

Application for the Papers should be made to Members of Congress, or to the Director of the U. S. Geological Survey, Washington, D. C.

It is announced that the first meeting of the International Seismological Society, formed in accordance with a decision of the Seventh International Geographical Congress, will be held at Strassburg, April 11, 1901.

Mr. Marshall H. Saville, of the American Museum of Natural History, will start for Mexico early in November to continue the excavations begun two years ago in the State of Oaxaca, and increase, so far as possible, the collections illustrating the culture of the Zapotecans.

The London *Athenæum*, of September 22, prints the following communication on the subject of the Hereford Map:

> The recent attacks on the authorities for neglect of this interesting map are undeserved, and the defence of the Dean complete. I have this week carefully inspected it, from the Holy Trinity at the top to the mermaid in the centre and thence to the devil at the bottom, *viâ* two Babylons, London and Salzburg. It is in perfect preservation and well watched over.—Reader.

The edition of the Jesuit Relations and Allied Documents in the original texts, with English translations and notes, begun by the Burrows Brothers Company in 1896, is practically finished, as appears by the following announcement on page 17 of Vol. LXX:

Vol. LXXI will contain the remainder of the text of our series. The Index will occupy Vols. LXXII and LXXIII.

The publishers are to be congratulated on the completion of a worthy enterprise.

ACCORDING TO THE REPORT of the Division of Forestry (U. S. Department of Agriculture) on the Big Trees of California, there are ten groups of these scattered along the west side of the Sierra Nevada, from the middle fork of the American River to the head of Deer Creek, a distance of two hundred and fifty miles.

The finest of all, the Calaveras Grove, with the biggest and tallest trees, came in April last into the possession of a lumberman, and the Mariposa Grove is the only one which can be regarded as safe from destruction.

The Report discusses the age of the Big Trees, and seems to find no difficulty in admitting that they have stood for five thousand years.

A writer in *Science* (Oct. 12, 1900) states that he once counted with much care the rings of growth of a tree which was felled in 1853.* The count was made from circumference to centre, and every ring was counted, no guess being made. There were 1147 rings, and the writer concludes that the tree was eleven hundred and forty-seven years old. He doubts—and with reason—whether any one of the existing Big Trees approaches the age of two thousand years.

Great antiquity has been ascribed to many trees—to the dragon-tree of Orotava,† the great chestnut on Mount Etna, the cedars of Lebanon, the Tasmanian eucalyptus, the baobabs of Senegal—but the estimate in every case is matter of conjecture. So far as historical records show, the oldest tree in the world is the famous Bo tree (*Ficus religiosa*) of Anuradhapura, in Ceylon. This was a branch of the tree under which Sakya-Muni became a Buddha, brought to Ceylon and planted there in the year 288 B.C. Sir J. Emerson Tennent cites, in his work on Ceylon, twenty-five texts which trace the biography of this sacred tree from the year of its planting down to the year 1739.

In a recent communication to the Académie Royale de Belgique,

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* This tree belonged to the Calaveras Grove, and its stump forms the floor of the so-called dancing pavilion. Its circumference is ninety-two feet, and the tree was three hundred feet in height.—(Hittel's *Resources of California*, p. 82.)

† This tree, which Humboldt regarded a hundred years ago as one of the oldest organisms on the globe, was nearly destroyed by a hurricane in 1868, and has since perished.

M. Jules Leclercq recounts the history and describes *de visu* the present condition of the bo tree. Its branches spread beyond the enclosure in which it stands and are supported by solid props, while the trunk is held up by masonry built against it as a kind of pyramid, which is raised higher from century to century. At the base are altars, on which the pilgrims lay their offerings of flowers.

CAPT. JOHN WALL WILSON, the last survivor but one of the Kane Arctic Expedition, died on the 21st of August.

THE BUFFALO SOCIETY OF NATURAL SCIENCES announces the decease, on August the 21st, at the age of seventy-one years, of David F. Day, a charter member of the Society, who served as its President and was for forty years its Botanist and one of its Directors.

BOOK NOTICES.

Tarr and McMurry's Geographies. First Book, Home Geography and the Earth as a Whole, 12mo, 279 pp. Second Book, North America, 12mo, 469 pp. : The Macmillan Company.

These volumes, by Professors Tarr of Cornell University and McMurry of the Teachers College, Columbia University, belong to a series of three text-books for grade schools, of which the third is to deal with Europe and the other continents. In the First Book 110 pages are devoted to home geography. The section topics are: Soil, hills, mountains, valleys, rivers, ponds and lakes, the ocean, the air, industry and commerce, government, and maps. It is urged that home geography should receive more attention, because geographic study must be based on experience. Thus only is the student prepared for advanced work.

The worthy attempt of the authors in this part of the volume brings out the intrinsic difficulty of preparing a general text-book of home geography. The principles of this phase of geographic education can be worked out, but they must be applied in detail by teachers on their own ground. The matter of home geography varies with every environment. The first eight sections furnish a simple and interesting treatment of elementary physiography, but they are not strictly home geography. The teacher and pupil may, however, derive from them much suggestion fruitful for such work. Professor R. E. Dodge has given, in the Journal of School Geography (Sept., 1900), a course in home geography adapted to New York City—an outline which adequately reflects the nature of such work.

Taking the book as a whole, there is little to criticise and much to commend. The aim at a juvenile style is perhaps too apparent in some passages, while in a few cases topics are introduced for which the preparation or age of the student is scarcely adequate. Figs. 17 and 30 are in point, in which the broad and generalized foldings convey an erroneous notion of mountain-making and of elevations of the land. Similarly formal and misleading is the illustration of valleys and divides, p. 29. A few of the cuts are too much reduced to have teaching value, as Figs. 117 and 176. But this is a common fault of text-books, and for the most part the illustrations in this are attractive and admirable. The maps are good in their expression and in their omission of details.

In the second part of the First Book we find Form and Size of the Earth, Zones, Heat within the Earth, Continents and Oceans, North America, the United States, and a brief account of other continents. The space is well proportioned. The United States are grouped as New England, Middle Atlantic States, including Maryland and the Virginias, Southern, Central and Western States.

We may take the Central States as showing the method of treatment. We find a good general map in color, an outline map of the wheat-producing States of the entire country, also of the chief cattle-raising districts. The pictorial illustrations include a harvesting view, a cattle farm, the Mesabi ore pits, Market Street in Chicago, cattle in the stock yards, and St. Anthony's Falls as affording mill-power. The causal principle is remembered throughout and illustrated in the industries of States, and the location and development of cities—for example, Chicago, Duluth, Minneapolis, and others. All this is in the compass of nine pages.

There are in the various chapters suggestions for what might be called laboratory exercises, and for collecting specimens, as iron ore, hard and soft coal, various rocks and grains. Visits are suggested, as to fish markets in New England and to manufacturing establishments. This, it may be remarked, is the way in which the home geography of the book most effectively comes in. A distinct advantage is rightfully claimed for the convenient size of the volume. A good list of reference books is added and a statistical appendix.

The excellence and variety of the maps are a feature of the Second Book. Besides the colored political maps we find an admirable series of nine reliefs from Howell's models. These include North America, the continental ice-sheet, two showing the United States (one carrying the names of physiographic regions) and the several groups of States. There are maps of the greater cities and a variety of meteorological charts. Among other maps we note those of Standard Time belts, the Fall Line, the Erie Canal, navigable rivers, railways, and several giving the distribution of agriculture and mining operations.

About one-fourth of the volume is occupied with a general geographical introduction, and the rest deals specifically with North America. The United States occupy 257 pages, and the treatment deserves the highest praise. Such a volume must command the student's attention and give him a generous knowledge of his own country.

We may take again the Central States. The nine pages of the First Book are here expanded to forty-seven. Several paragraphs give a simple narrative of the settlement of the Mississippi Valley. A good description of a farm in central Ohio helps to put the agriculture of the region into the concrete, and is a great advance upon the bare catalogues of products, of many geographies. Fruit-raising in a climate tempered by the great lakes affords one of the illustrations of causal geography which abound. Somewhat full accounts are given of wheat, corn, cattle ranching, lumbering, petroleum and natural gas and various minerals, especially iron. The treatment of Chicago is expanded to five pages, with proportionate accounts of the other great cities of the Central States.

Countries north and south of the United States follow with a concluding chapter, which summarizes and reviews the whole with maps and diagrammatic views of various industries. The authors have made a good contribution to educational geography, and the two volumes, with several other text-books of recent years, set forth the spirit and method of the new geography. A. P. B.

Through the First Antarctic Night, 1898–1899. A Narrative of the Voyage of the "Belgica" among newly discovered Lands and over an unknown Sea about the South Pole. By Frederick A. Cook, M.D., Surgeon and Anthropologist of the Belgian Antarctic Expedition. With an Appendix containing a Summary of the Scientific Results. Illustrated. New York, Doubleday & McClure Co., 1900. 8vo.

Dr. Cook says very truly, in his Introduction, that the credit of organizing the Belgian Antarctic Expedition belongs to its commander, Adrien de Gerlache, and that the voyage of the *Belgica* marks the beginning of a third revival of Antarctic exploration, in which the place of honour belongs, not to England nor to Germany, but to Belgium.

Full information on the results of the expedition is not to be expected for two or three years, but a summary by M. Emile Racovitza was published in *La Géographie*, No. 2, 1900. *

Dr. Cook boarded the *Belgica* in the harbour of Rio de Janeiro and then met for the first time the associates—Belgian, Norwegian, Russian and Rumanian—with whom he was to live for more than a year. The ship he found to be well built for her service and well equipped in every way.

In Beagle Channel Dr. Cook was able to observe the Fuegian tribes and study their way of life. There are three of these tribes—

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* This summary will be found in the Society's BULLETIN, No. 3, 1900, page 270.

the Alaculufs, the Yahgans and the Onas,—all reduced in number and the first two nearly extinct. The Onas, a race of giants, have so far refused to be civilised, and have kept themselves aloof from the white men. These, however, are steadily widening the area of their sheep farms and are pushing the Onas into the hills and mountains in the interior.

In stature the Ona men average nearly six feet, and their physical development is perfect. The women are not so tall, and they are somewhat corpulent.

The whole race numbers about sixteen hundred, divided into sixteen tribes, all dwindling away. They live by the chase in the hunting grounds still left to them, and by plundering the sheep farms.

Their ingenuity exhausts itself in making their weapons, and they go almost without clothing or shelter. Their bows are made of the wood of the Antarctic beech; the arrows of the reed-like branch of a tree called the Winter's bark, winged with bird feathers and tipped with glass.

The hut—if it can be so called—is made of a few branches and skins, forming a breastwork against the wind. At night the fire is allowed to go out, the children are put in the middle of a circle with the adults outside, and guanaco skins are drawn over all. Formerly their dogs slept on top of the Ona family and kept them warm; but the dogs have been killed off by the sheep farmers.

From Tierra del Fuego the ship made her way into the icy southern ocean.

Once fast in the ice the explorers took up the round of duties and amusements which enable men to live through their imprisonment in the polar wildernesses. Dr. Cook writes of these in a direct and interesting way, while he misses none of the strange effects of light and colour in the panorama before him.

The illustrations of this handsome volume were nearly all made from photographs, and the author gives expression to his surprise at the success attained in the reproduction of the coloured views.

ACCESSIONS TO THE LIBRARY.

JULY–OCTOBER, 1900.

BY PURCHASE.

The Annual Cyclopædia, 1899 (Appleton), New York, 1900, 8vo; Dictionary of National Biography, edited by Sidney Lee, Vol. LXIII, London, 1900, 8vo; The Voyage of Robert Dudley, etc., to the West Indies, edited by George F. Warner, London, 1899, 8vo (Hakluyt Society, 2d Series, No. III); The Journey of William of Rubruck to the Eastern Parts of the World, etc., translated by William W. Rockhill, London, 1900, 8vo (Hakluyt Society, 2d Series, No. IV); Un Outre-Mer au XVII Siècle, Voyages, etc., du Baron de La Hontan, Notes, etc., par François de Nion, Paris, 1900, 16mo; La Conquête de L'Afrique, par Jean Darcy, Paris, 1900, 16mo; Vie de Samuel Champlain, par Gabriel Gravier, Paris, 1900, 4to; Overland to China, by A. R. Colquhoun, New York and London, 1900, 8vo; The Mississippi Valley in the Civil War, by John Fiske, Boston and New York, 1900, 8vo; The Colombian and Venezuelan Republics, by William L. Scruggs, Boston and New York, 1900, 8vo; The Pilgrims in their Three Homes, by William Elliot Griffis, Boston and New York, 1898, 16mo; Appleton's Dictionary of New York and its Vicinity, New York, 1900, 12mo; China, the Long-Lived Empire, by Eliza Ruhamah Scidmore, New York, 1900, 8vo; Colonial Civil Service, by A. Lawrence Lowell, New York, 1900, 8vo; World Politics at the End of the Nineteenth Century, by Paul S. Reinsch, New York, 1900, 8vo; The Welsh People, by John Rhys and David Brynmor-Jones, New York, 1900, 8vo; Three Episodes of Massachusetts History, by Charles Francis Adams, Boston and New York, 1894–96, 2 vols., 8vo; Massachusetts, its Historians and Its History, by Charles Francis Adams, Boston and New York, 1898, 8vo; Vermont, by Rowland E. Robinson, Boston and New York, 1900, 8vo; Out of the East, by Lafcadio Hearn, Boston and New York, 1900, 8vo; Water Supply of Rome by Sextus Julius Frontinus, by Clemens Herschel, Boston, 1899, 4to; Letters received by the East India Company from Its Servants in the East, Vol. IV, edited by William Foster, London, 1900, 8vo; Map of China and Surrounding Regions, by E. Bretschneider, 2d Edition, St. Petersburg, 1900, 4 sheets; Stanford's Map of Eastern China, Japan and Korea, London, 1900, 1 sheet; China in Decay, by A. Krausse, Revised Edition, London, 1900, 8vo; Japan in Transition, by Stafford Ransome, London, 1899, 8vo; A Diplomatist's Wife in Japan, by Mrs. Hugh Fraser, 2d Edition, London, 1899, 2 vols., 8vo; Russia on the Pacific and the Siberian Railway, by "Vladimir," London, 1899, 8vo; The Silver Map of the World, by Miller Christy, London, 1900, 8vo; A Briefe and True Report of the New Found Land of Virginia, by Thomas Hariot, London, 1900, 4to; Thomas Hariot, the Mathematician, etc., by Henry Stevens, London, 1900, 4to; The Jesuit Relations and Allied Documents, edited by Reuben Gold Thwaites, Vols. LXVII–LXX, Cleveland, 1900, 8vo; Sir Stamford Raffles, by Hugh Edward Egerton, New York, 1900, 8vo; Ethnographical Album of the North Pacific Coasts, Part I, American Museum of Natural History, New York, 1900; Life on the Bosphorus, by W. J. J. Spry, London, 1895, 8vo; Three Years in Western China, by Alexander Hosie, London, 1890, 8vo; The Kilima-Njaro Expedition, by H. H. Johnston, London, 1886, 8vo; Through the Gold Fields of Alaska, by Harry De Windt, New York and London, 1898, 8vo; Fragments des Poëmes Géographiques de Scymnus de Chio, etc., publiés par J. A. Letronne, Paris, 1840, 8vo; Historia del Almirante de las Indias, Don Cristóbal Colon, por Fernando Colon, Madrid, 1892, 2 vols., 16mo; Conversión en Piritú (Colombia), por Ruiz Blanco, Madrid, 1892, 16mo; Milicia y Descripción de las Indias, por Bernardo de Vargas Machuca, Madrid, 1892, 2 vols., 16mo; Virtudes del Indio, por Juan de Palafox y Mendoza, Madrid, 1893, 16mo; Tres Tratados de América (Siglo XVIII), Madrid, 1894, 16mo; Relación Historial de Indios del Paraguay, por P. J. Patricio Fernandez, Madrid, 1895, 2 vols., 16mo; Repúblicas de Indias, Idolatrias y Gobierno, por Fr. Jerónimo Roman y Zamora, Madrid, 1897, 2 vols., 16mo; Ruiz Montoya en Indias, por Dr. D. Francisco Jarque, Madrid, 1900, 4 vols., 8vo; Bibliografía Española de las Islas Filipinas (1523–1810), por J. T. Medina, Santiago de Chile, 1898, 8vo; Memoria Descriptiva é Historica de las Islas Marianas, por F. de La Corte y Ruano Calderon, Madrid, 1875, 8vo; Journal du Voyage fait par ordre du Roi à l'Équateur, etc., par M. de La Condamine, à Paris, 1751, 4to; La Pacification de Madagascar, par F. Hellot, Paris, 1900, 8vo; Histoire de la Géographie de Madagascar, par Alfred Grandidier, Paris, 1885, 4to; Vingt Ans à Madagascar d'après les Notes du P. Abinal, par le P. de la Vaissière, Paris, 1885, 8vo; Vom Mittelmeer zum Persischen Golf, von Max Fr. von Oppenheim, *Band 2*, Berlin, 1900, 8vo; Der Kilimandjaro, Reisen und Studien, von Dr. Hans Meyer, Berlin, 1900, 8vo; Mission Scientifique dans la Haute Asie, 1890–1895, J.-L. Dutreuil de Rhins, Paris, 1897–1898, 3 tomes, 4to; La Province Chinoise de Yün-Nan, par Émile Rocher, Paris, 1879, 2 tomes, 8vo; Tales of Old Japan, by A. B. Mitford, 2 vols. in 1, London, 1871, 8vo; Physical Geology and Geography of Great Britain, by A. G. Ramsay, London, 1894, 8vo; Invasion of India by Alexander the Great, by J. W. M'Crindle, Westminster, 1896, 8vo; Journey in the Seaboard Slave States, by Frederick Law Olmsted, London, 1856, 8vo; Letters from the Slave States, by James Sterling, London, 1857, 8vo; The Story of Florence, by Edmund G. Gardner, London, 1900, 16mo; The Attaché at Peking, by A. B. Freeman-Mitford, London, 1900, 8vo; Russia against India, by A. R. Colquhoun, New York and London, 1900, 8vo; The Antarctic Regions, by Karl Fricker, London, 1900, 8vo; The Ascent of Mount St. Elias by H. R. H. Prince Luigi Amadeo di Savoia, Duke of the Abruzzi, narrated by Filippo de Filippi, Westminster, 1900, 8vo; The Redemption of Egypt, by W. Basil Worsfold, London, 1899, 8vo; In the Valley of the Rhone, by Charles W. Wood, London, 1900, 8vo; The Colonization of Africa by Alien Races, by H. H. Johnston, Cambridge, 1899, 8vo; Man, Past and Present, by A. H. Keane, Cambridge, 1899, 8vo; Ethnology, by A. H. Keane, 2d Edition, Cambridge, 1896, 8vo; Outlines of Military Geography, by T. Miller Maguire, Cambridge, 1899, 8vo; History of Ancient Geography, by H. F. Tozer, Cambridge, 1897, 8vo; Correspondence relating to the Condition of the Pitcairn Islanders, London, 1899, folio; Description Hydrographique et Historique des Marais Pontins, par M. de Prony, à Paris, 1822, 4to, et Atlas, 1823, folio; The Dolomite Mountains, by J. Gilbert and G. C. Churchill, London, 1864, 8vo; Five Years' Experience in Australia Felix, by G. H. Haydon, London, 1846, 8vo; Records of the City of New Amsterdam in New Netherland, edited by Henry B. Dawson, Vol. I (all published), Morrisania, N. Y., 1867, 8vo, paper.

GIFTS.

From Armand Colin & Cie, Publishers, Paris:

La Face de la Terre, par Ed. Suess, tr. par Emm. de Margerie, *Tome II*, Paris, 1900, 8°.

From Frederick A. Cook, Author:

Through the First Antarctic Night, 1898–1899, New York, 1900, 8°.

From William Morris Davis, Author:

Glacial Erosion in France, Switzerland and Norway (*Reprint from Proceedings*

Boston Society of Natural History, Vol. 29, No. 14), Boston, 1900; Glacial Erosion in the Valley of the Ticino (*Extract from Appalachia, Vol. IX, No. 2, March, 1900*); The Freshwater Tertiary Formations of the Rocky Mountain Region (*Extract from Proceedings of the American Academy of Arts and Sciences, Vol. XXXV, No. 17, March, 1900*); The Physical Geography of the Lands (*Reprinted from Popular Science Monthly, Vol. LVII, No. 2, June, 1900*); Balze per Faglia nei Monti Lepini, traduzione di Fr. M. Pasanisi, Roma, 1899.

From Mrs. J. Haven Emerson:

Black's General Atlas, Edinburgh, 1841, folio.

From Dr. J. Haven Emerson:

The following maps: Postcurs von Deutschland, Beutlingen, s. a.; Greece, N. & S. S. Jocelyn, New Haven, 1824; Italien, C. F. Weiland, Weimar, 1821; City of Dublin, Wilson's Directory, 1800; Pianta Litorale, Regno di Napoli fino a Pesto, N. Gervasi, Napoli, s. a.; General Charte von Schweiz, C. F. Weiland, Weimar, 1821 (2 copies); Pays-Bas, Ferra ainé, Bruxelles, 1819; London, John Dower, London, 1862; London, Samuel Leigh, London, s. a.; New York, W. Bradford (facsimile), New York, 1834.

From Max Fleiuss, Author:

Os Centenarios do Brazil, Rio de Janeiro, 1900, 8°.

From Alejandro Gancedo, Author:

Canal Navegable de Santiago del Estero al Rio Paraná, Buenos Aires, 1900, 8°.

From Wm. Paul Gerhard, C.E.:

Second Report of the U. S. Board on Geographic Names, 1890–1899, Washington, 1900, 8°.

From Thomas Jefferson Hurley, Author:

Famous Gold Nuggets of the World, s. l., 1900, 16°.

From Jules Leclercq, Author:

L'Indépendance des Boers et les Origines des Républiques Sud-Africaines. (Extrait de la Revue des Deux Mondes du 1er Juin, 1900), Bruxelles, 8°.

From The Macmillan Co., New York:

Tarr and McMurry's Geographies, 2d Book: North America, by R. S. Tarr and F. M. McMurry, New York, 1900, 16°.

From Cl. Madrolle, Author:

Hai-Nan et la Côte Continentale Voisine, Paris, 1900, 8°.

From the New York Produce Exchange:

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From Manuel M. de Peralta, Author:

La Géographie Historique et les Droits Territoriaux de la République de Costa-Rica, etc., Paris, 1900, 4°.

From E. A. Tredwell:

The following maps: S. E. Coast of the United States and the British West India Colonies, New York, s. a.; City of New York, N. Y., s. a.; Chile, B. Vicuña Mackenna, New York, 1866; Map and History of Cuba, by Lieut. E. Hannaford, Springfield, Ohio, 1897; Cyclist's Road Map of New York, 6 sheets, New York, 1893; Bradshaw's Railroad Map of Europe, s. l., s. a.; Andrews' Report on Lake Trade Maps, 1855; Twelve magazine and newspaper maps of Sahara R.R., Mississippi Delta, Great American Desert, etc.

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Scrambles amongst the Alps in the Years 1860–1869, 5th Edition, London, 1900, 8°.

THE SOCIETY'S HOUSE ON MANHATTAN SQUARE.

In presenting to the Fellows the accompanying illustrations of the Society's house, now in process of construction in West Eighty-first Street, on Manhattan Square, it is proper to acknowledge, with thanks, subscriptions to the Building Fund received during the summer to the amount of $2,455.00. Including these, the whole amount thus far received from Fellows of the Society in response to the circular letter issued by the Council in February, 1899, is $32,155.00, contributed as follows:

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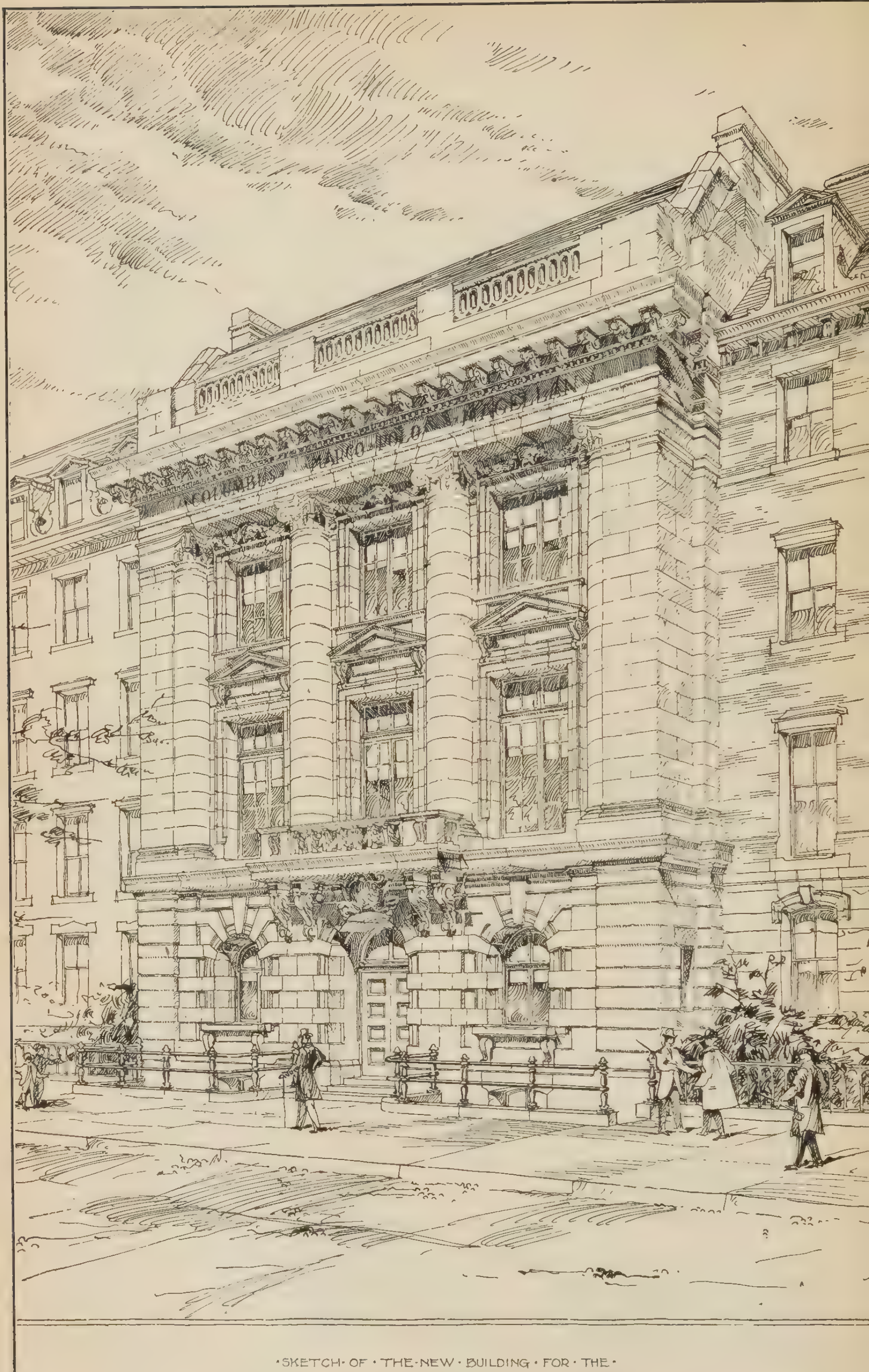

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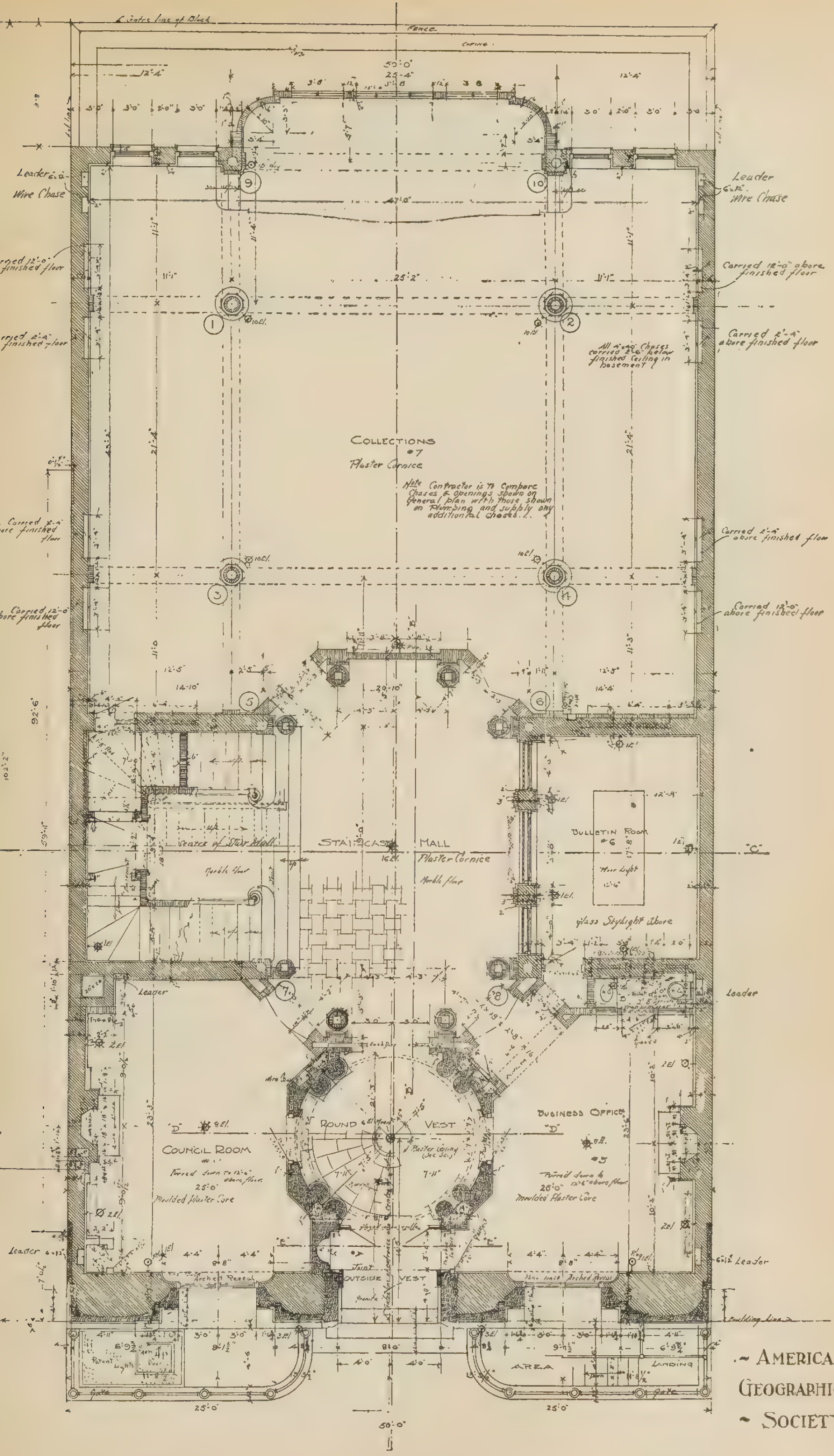

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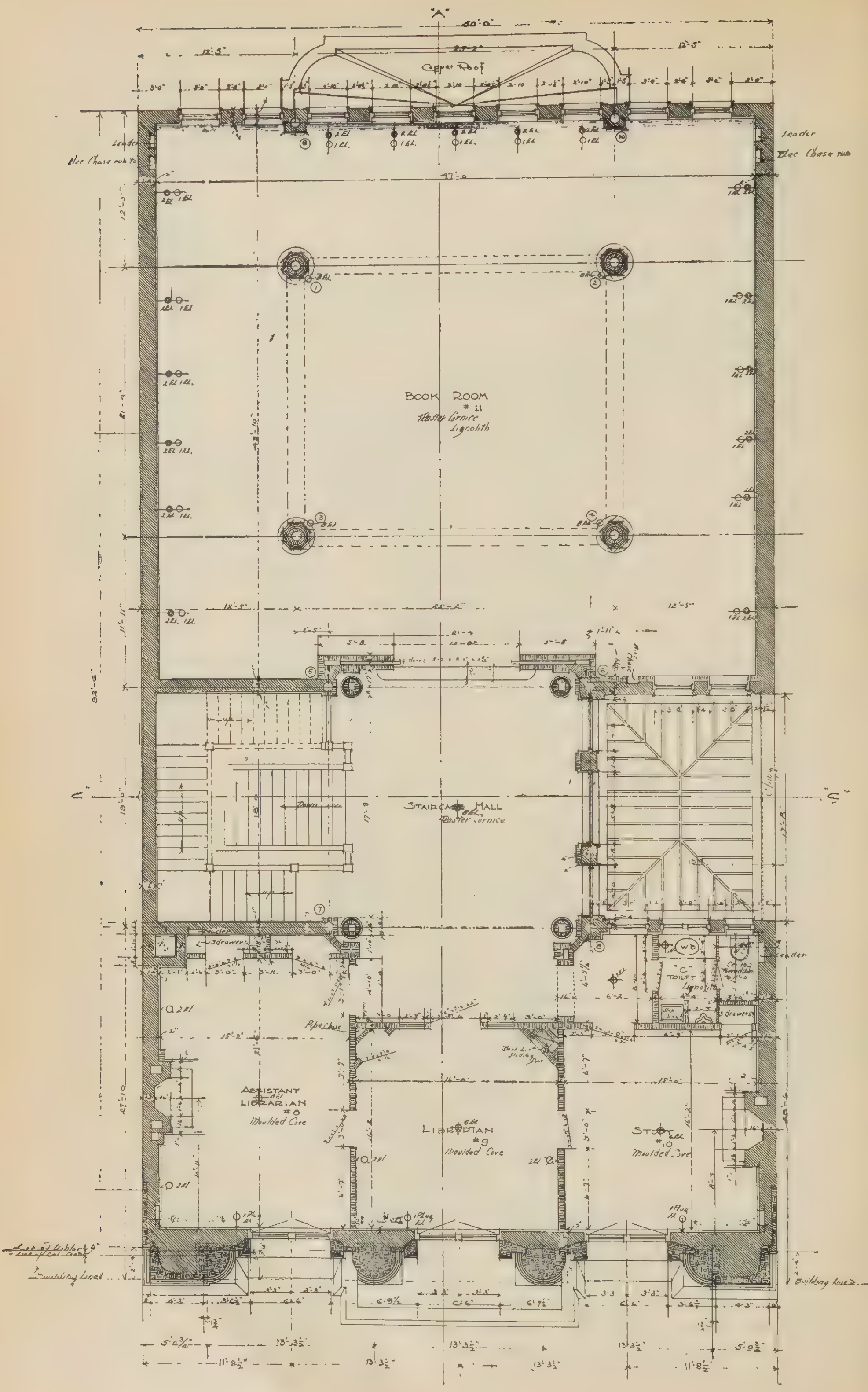

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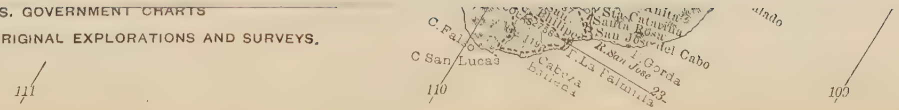

AFTER U. S. GOVERNMENT CHARTS

THE INTERIOR AFTER ORIGINAL EXPLORATIONS AND SURVEYS.

BULLETIN

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AMERICAN GEOGRAPHICAL SOCIETY.

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EXPLORATIONS IN THE CENTRAL PART OF BAJA CALIFORNIA.

BY

GUSTAV EISEN, PH.D.

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1. INTRODUCTORY.—The following account of some of my late travels in the central part of Baja California is based upon several voyages made during the last three years. My previous journeys to the Cape Region of this peninsula have already been described in the Proceedings of the Cal. Acad. Sci. in 1895 and in the Journal of the AMERICAN GEOGRAPHICAL SOCIETY in 1897. The object of these journeys has been one and the same—the horticultural, botanical and zoological exploration of the district. During my last journey from Loreto to Sierra Pintada special attention was also paid to the mineral resources of the district, and especially to the placer mines then lately discovered, and about which a "boom" had spread even to the United States. During these various voyages I have repeatedly visited at first the Cape Region, extending from Cape San Lucas to La Paz, and later on the country north of La Paz to near

the 29th parallel. My last voyage (June–August, 1894) extended overland from Loreto to Sierra Pintada, a rocky promontory on the Pacific side west of San Ignacio. As the incidents of these trips are less interesting from a geographical point of view and more suitable for a book of travel, I will in the following paper confine myself to such data and details as will illustrate the nature and aspect of the central part of this very interesting and yet little-known peninsula. In this connection I wish it to be distinctly understood that what is said here relates exclusively, except where otherwise stated, to the central part of Baja California. Both in the Cape Region and in the northern part of the peninsula the conditions are somewhat different.

The most easy way to reach the southern and central parts of Baja California is by steamer from San Francisco, one leaving the 7th day of every month. It takes two days to reach Ensenada de Todos Santos, on the Pacific coast, near the United States boundary line, and it takes four additional days to arrive at San José del Cabo. At this place the steamer stops half a day or so, and there is opportunity to visit the town and the many interesting gardens and plantations surrounding it. In two days more we arrive with the same steamer at La Paz, the capital of the southern district of the peninsula. Here we exchange our commodious steamer *Curaçao* for the miniature steamer or tugboat *Rio Yaqui*. This little miserable boat—which, I understand, now lies at the bottom of the Gulf—was never intended to accommodate any passengers. It had only berths for six, but the company had sold tickets for 75 persons, and consequently there was no room even to move. However, after two days we reached Loreto, and landed without any adventure with the sharks. At Loreto we remained long enough to get an outfit, consisting of mules and a guide. The principal merchant in town, Don Juan Antonio Romero, took us kindly in hand, and did us much valuable service. He even extended his courtesy so far as to accompany us to San Xavier. San Xavier, or rather San Francisco Xavier, is one of the most interesting places in Baja California, the beautiful Mission church being the handsomest building on the peninsula and the best-preserved Mission church on the Pacific coast outside of the mainland of Mexico. It is built of cut stone in a noble Romanesque style, and is worthy of special care by the Government. However, this care, so necessary in order to preserve it, does not seem to be forthcoming, and as a consequence the inevitable destruction will soon follow. At the first approach to the narrow cañon in which this church suddenly looms up, one is amazed at the presence of such a beautiful structure in such an isolated place. Surrounding the Mission there are now, perhaps, only fifty acres in all cultivated and irrigated, while enclosing these rise tremendous perpendicular walls of a narrow gorge, beyond which on every side are other narrow cañons and desert hills without water and without population. The explanation is that formerly this country was inhabited by numerous Indians, whom the missionaries struggled hard to convert and civilize. As there was a small but constant stream of water in this cañon, a Mission was early established there. The beautiful church was built partly and principally with money derived from the pearl fishery, which in early times was much more profitable than now.

It was our intention to follow the trail from San Xavier northwards through the central part of the peninsula as far as San Ignacio, and from there to strike across to the rocky promontory of Santa Clara and Sierra Pintada. But circumstances made it necessary to return to Loreto, and after some new arrangements, to make a new start direct for Comondú. I had at first intended to follow the central route or trail which passes over the mountain chain or sierra, but I soon found that this route was entirely impracticable for any one with limited time. The sierra is only rarely traversed by any other than stock men, and the trails are not such as can be used by pack animals without much loss of time. After the first few days of struggle over rocks and down steep ravines, I decided to follow the least difficult and tedious trail in order to reach Santa Clara within the time previously set. From Loreto there are three different trails running parallel through the peninsula, northwards as well as towards the south. One trail follows the east or Gulf coast, another passes along the backbone of the sierras, and a third one passes more to the westward, here and there skirting the Pacific and now and then turning towards the centre in order to touch some small town or village. This latter trail is by far the most travelled of the three, as it is also the least troublesome to follow. When we speak of trail or road in this part of Baja California we must not misunderstand the meaning. There is no such thing as a road in the central part of the peninsula, and what we designate as trail is often only a more or less distinct path made by the mules and cattle. In very few places has any work been done in order to improve the trails, except in the immediate vicinity of the villages, where it was absolutely necessary to do something in order to prevent loss of life and property. It appears, however, that during the early part of the Spanish occupation some work was done with the aid of Indian labor, which at that time was to be had, and there are traditions that some remarkable roadwork, the remains of which are yet seen in the vicinity of San Ignacio, was actually made by the Indians before the Conquest.

I will now shortly refer to the places passed through on my last trip. It must be remembered that the name of almost every place mentioned is also the name of the arroyo or river-bed in which it is situated. Many places referred to are mere ranches, some of which are only inhabited during the rainy season, on account of absence of permanent water supply. In the central part of the peninsula—from La Paz northwards—there are only very few places which might be called towns. These are San Luis, Loreto, Comondú, Purísima, Mulejé, Santa Rosalia, and San Ignacio, and even the best of these are only villages. However, in a country where no larger places exist the smaller ones become of importance, and even ranches and arroyos are given a prominence which they would not attain in more settled countries. We must remember that in Baja California the traveller is happy if he can find water enough to satisfy his thirst, and, accordingly, water-holes even become of unusual importance and worthy of being marked down and correctly located on the map.

At this place I will take occasion to say that the peninsula which to us is known as Lower California is known to the Mexicans as Baja California. The southern part of our own California is known to ourselves as Southern California, and it is of importance in speaking of these countries not to confound the names of the two. To the Mexicans, as well as to the early settlers—the Forty-niners—in our California, this, our State, was known as Alta California, which in English means Upper California. In order to make clear what country is meant I have often used this word as a distinction from Baja California.

2. NOTES ON PLACES OF INTEREST AND IMPORTANCE BETWEEN LORETO AND SAN ROQUE.—LORETO, once the most prominent place in Baja California, is now a mere village of a few hundred inhabitants. The once fine church, with its famous "Virgen de Loreto," is now in ruins. From Loreto the road or trail passes due west, ascending the Sierra and passing the crest at a point called Las Parras, situated at an elevation of about 1,800 feet. Stopping-places are San Telmo, where there is a spring of water, and San Matías—the latter only a camping-place for the night, about 1,800 feet above the sea.

San Matías.—Camping-places on the road are Santa Isabel, where lunch is taken; Santa Lucia, a ranch with water; Arroyo Palmadito, so called on account of groves of the large fan palm (*Washingtonia Sonoræ*). Mesa de los Pilares is a high table mountain to the left. Camp at a ranch, El Quiñi, where water is found.

Quiñí.—Starting at sunrise from El Quiñí, we reach Comondú at 9.30 A.M. It is said to be about sixteen leagues between Loreto and Comondú—not in a direct line, but as the road runs. At Comondú there are two settlements in the same arroyo. The village proper situated further down the arroyo is known as San Miguel de Comondú, while the Mission, situated one league higher up to the east, is called San José de Comondú. Comondú is one of the most important places in Baja California.

Comondú.—Leaving Comondú in the early morning, we rest at noon in the Arroyo Pabellón, and stop at night at San Vicente, a ranch where water is found. Between Comondú and San Vicente the distance is about eight leagues.

San Vicente.—Leaving that place in the early morning, we reach the village of Purísima at 9.30 after a two-league ride. From Comondú to Purísima is said to be from nine to ten leagues. Purísima is situated eight leagues from the Pacific Ocean, and from eighteen to twenty leagues from the Gulf. From Purísima to San José de Gracia there are said to be forty leagues. In Purísima we remain several days in order to recuperate the animals.

Purísima.—Leaving Purísima in the afternoon at 3, we reach camp at the Arroyo Guajademí, where only bad water is found. Guajademí is also the name of a high mountain peak.

Guajademí.—Starting at 6 A.M., we camp at noon in the Arroyo El Mezquital. At San Juanico, close to the shore of the Pacific, we find water at 5 P.M. But, as there is no feed for the animals, and as the water is undrinkable on account of the multitude of coyotes which visit the spring nightly, we continue on the road a few miles to a small arroyo, El Mezquitito, where there is feed for the mules, but no water.

Mezquitito.—At this place there is nothing but open desert and an arroyo a few feet deep. We start at sunrise and arrive at Cadejé at 9.30 A.M., after having passed the arroyo of Carrizal.

Cadejé.—There are half-a-dozen houses and quite a stream of good water and some plantations. Between Carrizal and Cadejé there is a league and a half. From Cadejé to San Raymundo there are two leagues, and from San Raymundo to San Juan there are two leagues more. At San Raymundo there is water, but we pass on to the Arroyo San Juan, where we camp. Here there is no water. The arroyo of San Raymundo is one of the largest in this part of the country; but there is little water found there, and that is bad.

SAN JUAN.—From this place to Los Dolores, a small arroyito, there is a league and a half. From Los Dolores to Arroyo de las Vacas about a league and a half. From Las Vacas to San José de Gracia there is about one league. As there is an abundance of water at this place, and some very fine orchards and other plantations, we camp here early in the afternoon.

SAN JOSÉ DE GRACIA.—A small village. We start early in the morning and camp at the ranch San Benito at noon. Here is plenty of water for stock and some for irrigation purposes, but the land is limited. We start again in the afternoon and reach in the early evening Patrocinio.

PATROCINIO is situated twelve leagues from the Pacific Ocean and about thirty leagues from the Gulf of Cortés. Patrocinio is a small hamlet, with, perhaps, fifty houses of the most poverty-stricken kind. We start early in the morning and rest at noon at Jesus Maria, where there is water, and camp at night at the Arroyo Estiladera, where water is also found.

ESTILADERA —We leave early in the morning and rest at noon at a ranch, San Joaquín, where running water is found. At night the same day we reach San Ignacio.

SAN IGNACIO.—This is the largest place in the central part of Baja California; but as more will be said about it later, I will content myself here by stating that San Ignacio is the meeting-place for all the trails in this part of the country. Mules and guides can be readily procured here. From San Ignacio a vast plain extends to the Coast Range on the Pacific side. This plain is at present an immense desert, with little or no water, and difficult to cross. Until the year of my visit this plain was seldom traversed, but on account of the discovery of gold in the Sierra Pintada a stream of gold-seekers had now found their way across this barren and inhospitable country, and a regular trail had been trodden in the sand —so plain, indeed, that there seemed little or no danger of getting lost. Still, several parties had gone astray, and some had lost their lives in the sandy waste. We leave San Ignacio after having procured a new outfit of mules and a guide, and start down the arroyo at 3 P.M. Camp on the plains between the arroyos San Juan and San Angel. At San Angel is the last water to be found, and we must traverse the plain without further supply, the next watering-place being the Tinaja de Santa Clara.

SAN ANGEL.—We start early, and after a few hours' ride arrive at the arroyo of San Angel. Several springs in the arroyo, and the water is fair in at least one of them. From there the road leads across the desert due west and we begin to ascend the Santa Clara mountains in the evening. Camp in the foot-hills, or rather on the slope of the mountain, near a peak called the Tecolote (the Owl), on account of its resemblance to an owl's head.

EL TECOLOTE.—As there is no water at this place, and as we have had no water since six yesterday morning, we start early only to find that the mules have run away. It takes several hours to find them, and a long delay is caused. We arrive at 9 A.M. at the Tinaja de Santa Clara, a deep water-hole in a gulch. This water is the best in the whole of this region; but thousands of human beings and mules have drunk the pond almost dry, and the water has been much contaminated. We rest here only long enough to recuperate, and reach in the evening the arroyo of San Lorenzo, where there is another water-hole. But as this water is said to cause the death of animals, and as poisonous plants are said to abound near the arroyo, we consider it best not to tarry here but to start up the coast. At 10 P.M. we reach a place suitable for camping at the foot of Cerro Prieto. Here is no water and scarcely any feed. Having ridden since sunrise, or about eighteen hours, we are completely worn out. This is a desolate place and the most inhospitable camp.

CERRO PRIETO.—The camp is named after a dark hill standing out prominently from the other more distant mountains. We leave as early as is possible, the mules, as usual, having run away in search of food. We ride all day and pass two small arroyos, Saladito and San Rafael. In both there is some salty water in shallow, dug wells. We stop at noon at San Rafael and camp at night at La Huerta, a most beautiful little arroyo, where, however, there is no water—no well dug. But there is an abundance of finest feed and many flowers. Thousands of cotton-tail rabbits. Everything indicates that water is very near the surface. Between Cerro Prieto and La Huerta rain has lately fallen, and there are many flowers.

LA HUERTA.—The name is given by our party, no name existing previously. We start rather early, long before sunrise at 3 A.M., and arrive at San Andrés in time for breakfast. The bed of La Huerta is covered with large clumps of mezquite trees.

San Andrés.—This place is merely a camp for the miners. There is one house and a dozen tents. There are also about a dozen dug wells at the base of a hill. From these wells water is carried on donkeys to the placer mines, some sixteen to twenty-five miles due east, up in the mountains. From San Andrés there are only a few miles down to the landing-places of San Roque and Asunción, the latter being the safer. Both are open roadsteads and only poorly protected by promontories.

3. Rainfall and Climatic Conditions.—The climatic conditions of Baja California are but little known. The peninsula receives its rainfall from two distinct sources and at two different times. In a former paper I have stated that the rainfall of the Cape Region from La Paz to San Lucas differed from that of the other part of the peninsula. This statement is not quite correct, as several visits to the central part of this country have satisfied me that the change from the tropical region to the one next north of it is not as sudden as at first I believed. The general rule is that Baja California enjoys summer rains on its Gulf coast, while on the Pacific coast it receives principally the scanty winter rains. The summer rains are the tropical rains which originate in the Gulf of Mexico, and are carried over the Mexican mainland and precipitated on the higher eastern coast of Baja California. These rains are strongest in the Cape Region, or rather on the mountainous part of the Cape Region in the vicinity of San José del Cabo, and diminish from there towards the north. At La Paz rain does not fall every year. But north of La Paz the rainfall on the Gulf coast begins to increase, this being due to the high and narrow sierra which follows closely the line of the coast, and extends almost uninterruptedly as far as Alta California. It follows that the whole country enjoys to a larger or smaller degree the benefits of these tropical summer rains, which, however, are neither general nor certain. While the high sierra always receives thunder-showers in sufficient quantity to procure a crop of grass for the stock, the lower regions receive much less rain, and that at a slightly later time. Thus the eastern coast has rain every year in small quantities as early as July, while the western coast may get its rain a month or so later, if at all. The western coast may not have any rain for three or four years at a time, while on the eastern coast the rain may be considered regular, though scant. On the eastern side the summer rains extend,

as stated, as high up as to California, while on the western slope San Quintín may be said to be the highest point north to which the tropical summer rains ever reach. This is the more worthy of notice as the peninsula is so very narrow. The reason is, however, evident. The tropical rains coming from the south precipitate on the cooler eastern sierra; but as the country is gradually sloping towards the west, it follows that this part is less frequently cool enough to precipitate the rainfall. This tropical rainfall can be traced as far up as the centre of Alta California. Here it manifests itself by occasional thunderstorms in the Sierra Nevada, generally in the month of August. It is the same tropical rain-belt that furnishes Sonora and Arizona with their summer rains, which occasionally extend even over the Yuma and Colorado deserts.

As regards the quantity of rainfall nothing is certain, as no measurements have ever been made. I estimated the rainfall in the sierra of the Cape Region at some thirty inches. It is safe to say that this rain diminishes as we proceed northwards. It is dependent upon the height of the sierra. The high peaks receive more than the lower ones and the mountains more than the lowlands. At the high San Pedro Mártir, which probably is over 10,000 feet high, the rainfall is probably equal to that in the sierra of the Cape Region.

The other source of rainfall is the northern rains from Alaska. The west coast of Baja California gets the tail-end of these rains—not regularly, but in a most sporadic manner, and as far down as to the Cape San Lucas. These rains, which generally come late in the winter, in January or February, can never be depended on. They may come every year for several years in succession, or, on the other hand, they may be absent for from two to ten years.

As has been stated, the summer rains commence generally in July and last until October. They are most capricious as regards time and locality, and while one place may be deluged another close by may never receive a drop. This is frequently seen in passing through the country. In some places I found flowers and grass in abundance, and the animal life was represented by thousands of snails crawling on the bushes. A few yards or a mile away everything was barren, dry and dead, no rain having fallen there for years. When the water comes down it generally comes in torrents, washing everything before it. This torrential rain, which may amount in a single shower to three or four inches, has thus rarely the opportunity to sink deep in the soil. On the contrary, it carries everything before it, and leaves its trace behind in the formation of the precipitous walls of the cañons and in great washouts. The amount of rain that may fall in a single season has never been ascertained. It is probably much greater than would appear from the vegetation on the ground, most of it running to waste before entering the soil. From experience in Alta California I doubt if the annual rainfall anywhere on the east or Gulf coast will reach ten inches, except, perhaps, in the highest peaks, where torrential rains are more frequent. On the western, or Pacific coast, the rainfall probably seldom reaches even six inches. But as this scanty rain falls at a time when there is little or no frost, it enables the vegetation to start at once, and every drop almost which sinks into the soil is utilised by the immediately sprouting plants.

To recapitulate and summarize, we find that the peninsula of Baja California is only scantily supplied with rain. The summer rains extend from Todos Santos and Cabo San Lucas, in the south, as far up as to the Sierra Nevada, in the northern part of Alta California. These summer rains are most frequent and heavy in the Sierra backbone, which runs along the east coast of Baja California; but it extends also down to the east shore-line as well as to the western coast. Thus the central strip, half way between the two shores, receives more or less rain yearly, but as we approach the Pacific shore the rain becomes more uncertain and sporadic during the summer time; this being due to the absence of high mountains on this side. But this want of summer rains is to a very slight extent compensated by the presence of winter rains, which now and then extend from Alta California down to the Pacific coast, even as far south as San José del Cabo. These winter rains never enter the Gulf, and they diminish in quantity and regularity as we go south. Down as far as San Quintín they may be considered fairly regular, but below this point they become very uncertain. The reason why San Quintín appears to be somewhat of a terminus for both the southern and the northern rains is probably due to the vicinity of the highest mountain or sierra in Baja California. The height of the San Pedro Mártir sierra is such that it precipitates with facility both the rains coming from the north during the winter and from the south during the summer time.

4. WATER-COURSES AND SPRINGS.—The torrential rainfalls give to the whole of Baja California its characteristic appearance. The country consists of one mass of parallel arroyos or dry water-courses, the majority of which carry water only during and immediately after the rains. During the rainy spells the water in the

arroyos carries everything before it, but as soon as the rain is over the water disappears. Only in a few arroyos is there any kind of permanency as regards the water supply, this being mainly due to the nature of the rock or strata underlying the river beds. Thus, in the arroyo of La Purísima we find a succession of water-holes, some probably one hundred feet deep. Between these water-holes the water flows the year round in a tiny streamlet—enough, however, to secure a fair supply for irrigation, while in the deep water-holes we find fish and water terrapins of large size. Nowhere else are there as many water-holes as in La Purísima, and looking down on the arroyo from the top of the mesas, it appears as if there was actually a broad and continuous stream coursing down the cañon. But this is a deception, and upon closer inspection we find that there is a mere succession of water-holes, with the tiniest stream of water passing from one to the other. This, of course, refers only to the end of the dry season, as during the early part of this season, and after the rains, a large quantity of water runs down the river-bed. Of all the arroyos in this part of Baja California that of Purísima carries the largest amount of running water. In some other arroyos we find fair supplies of water for irrigation, but the water is of a different nature, as concerns its origin.

We now come to a feature highly characteristic of Baja California—springs and water-holes. We will first consider the former. Springs, in the sense understood in the United States, are rare in Baja California, and I know of comparatively few places where water gushes out of the hillside, forming a regular spring, such as we find everywhere in rainy climates. In the mountains of Baja California such springs are naturally less rare, but on the lower lands we may hunt for them in vain. Wherever springs are met with, in ninety cases out of a hundred they are situated in the river-beds or in the beds of otherwise dry arroyos. They either gush out from the bottom or from the sides of the cañon walls, and we are almost sure to meet with a farm or a village close at hand. The majority of these springs are small and do not suffice for extensive irrigation, but in a few instances they are enormously large and sufficient to irrigate thousands of acres. I have in a former paper on the Cape Region called attention to the large spring at San Bartolo which pours out from under a stratum in the bank of the cañon and actually forms a small creek of its own, irrigating the whole cañon for several miles. A similar condition exists at Comondú and at San Ignacio. At Comondú we find two large springs rushing out from under rocks in the dry river bottom and supplying a settlement of several thousand acres. The two springs are situated perhaps one hundred feet apart, one on each side of the narrow cañon, and each must carry some ten feet of water per second. The supply has always remained the same as far as the memory of man goes. Above these springs the cañon is dry and barren, while below them we find a most luxuriant and tropical vegetation of date palms, bananas, figs, sugar-cane, etc.

The most famous of all these springs is, however, the large spring or springs of San Ignacio. These springs originate also in the bottom of the cañon, and so great is the water supply that a regular creek is formed, which not only irrigates the country for miles below but in places forms regular swamps. From these springs some fifty thousand date palms are irrigated, besides fields of maize, beans, etc. Smaller springs of a similar nature are found in many arroyos, as, for instance, at San José de Gracia, San Benito, and hundreds of other places. Water-holes constitute a feature peculiarly characteristic of Baja California. These water-holes are found only in the bottom of some arroyo, generally in the trap rock. If it were not for these water-holes all travel in Baja California would be impossible during the dry season. In order to find the holes it is necessary to have the assistance of a guide, as there are no superficial features which would indicate them from a distance. We come upon them suddenly and lose sight of them as suddenly again, hidden as they are between perpendicular rocks and often without any surrounding vegetation large enough to be seen at any considerable distance. In many of these holes small fish as well as water terrapins—the latter known as *ahuamas*—are found, indicating that the water supply must be constant. Such water-holes are known to the natives as *tinajas*. They are found in the most unexpected places, the large Tinaja de Santa Clara, for instance, being situated high up in the Santa Clara mountains, among rocks of extreme barrenness.

5. ASPECT OF THE COUNTRY.—The central part of Baja California may be described as a vast elevated plain covered by a thick layer of trap rock. Above this plain there rises all along the east coast a high crest, a sierra of granite, the peaks attaining a height of from 2,000 to 3,000, and in isolated instances even as high as 10,000 feet. From this main sierra the country slopes gradually to the Pacific and much more speedily to the Gulf coast. West of the sierra backbone the sloping plains are cut through by innumerable arroyos or river-beds, while above the general level of the plain

rise thousands of isolated table mountains known as *mesas* and *picachos*. The *mesas* are the flat lava-covered mountains, while by *picachos* are understood those mountains which have had their tops worn down and have assumed a more pointed appearance. The nature of the high granite peaks of the sierra is that of sharply-pointed barren pinnacles, most beautiful on account of their wild and irregular form, the absence of trees causing them to stand out more sharply. The lava, or rather the trap rock, is the most prominent feature of this part of Baja California. It seems that in a not very remote geological period this whole country has been flooded from one end to the other by numerous eruptions of basalt or trap, which, when cooling, assumed the well-known forms of innumerable narrow parallel columns. Nearly all the cañon walls and walls of the river-beds consist of such perpendicular columns, and when travelling through any one of the many cañons we may without much difficulty imagine that the walls on either side have actually been built up by artificial means. But it is not only in the walls of the cañons that we meet with these rocks. The whole country is overlaid with them to such an extent that we may travel for days over hundreds of miles without finding any other surface than basalt. In places the columnar nature of this rock has caused the surface to be broken up into continuous piles of basaltic stones, situated so close together that it is impossible to step anywhere except on a rock. Such is the nature of hundreds of miles of territory, the whole surface of which looks as if it had been most skilfully paved with rocks from the size of an egg to that of a small barrel. Between these rocks there may or there may not be a few inches of ashy soil deep enough to sustain a few grasses or bushes or a few agaves or cacti. As to the possibility of farming this land it is simply out of the question, except in the arroyos or on the deep and softer soils in the immediate vicinity of the coast. But the great plains of the interior of this part of Baja California must forever remain the barren waste they are to-day, only suitable for occasional grazing by cattle. This lava or basalt blanket, which covers everything, varies greatly in thickness. In places it seems only a few feet thick, while in other places we can see how the water-courses have cut their way through hundreds of feet. Here and there on the plains we meet with smaller or larger piles of trap rock, appearing as if they had been piled up there carelessly in order to be ready to supply some intended gigantic building. These are evidently places of eruption, from which the basalt has spread in all directions, like a puddle of cement, over its gravelly bed. Within a few miles of the coast this basalt blanket generally gives out, having been washed away or undermined by the torrential floods and rains. In such places the land is slightly rolling, exposing the white or yellowish, ashy and volcanic soil underlying the great basalt covering. Such is the aspect of the country from La Paz to San Ignacio and San Roque in the north. As all the settled places, without any exception, are situated in the bottom of some cañon or arroyo, they do not in any way disturb this general aspect of the country. The settlements are never seen from any distance, but we stumble upon them suddenly and unexpectedly, their vegetation even never projecting above the general level of the plain.

The sierra backbone is a most interesting one. The view of the high and picturesque peaks may be enjoyed already from the Gulf. They assume the most fantastic forms, often of great beauty, especially when colored by the glorious and marvellous sunsets of this region. In the high sierra we meet with an increase of vegetation, and pines and palms are there common in the most favored localities. Seen from a distance, however, the peaks look barren and bare, and do not present any outlines rounded by forests. Such forests are found only in the sierras of the Cape Region and on the top of the high San Pedro Mártir.

Volcanoes are not unknown in this country, though none is now active. The largest volcano is the one known as Las Virgenes, situated northwest of Santa Rosalia. It may be seen from the Gulf, and presents a fine and magnificent view. As I have not ascended any of the high mountains in this region, I can only refer to them in a general way.

As regards vegetation, little can or need be said. To the botanist there is an endless variety of interesting and remarkable plants met with everywhere, but to the average traveller there is little to charm the lover of forests and trees. The great basalt blanket is barren, and presents no trees. Here and there we find thickets of shrubs and cacti, small in height and dry in appearance. In favorable places, where the basalt has become more disintegrated, these shrubs grow higher and denser, and we find even thickets of the agave used by the natives for the distillation of mezcal. It is especially the slopes of the walls of the cañons which offer the best-growing places for the agave, but occasionally we also find it on the mesas, where the soil is deeper and where the basalt blanket has been broken up.

In the river-beds we sometimes meet with a dense and most picturesque vegetation. Here are enormous, tall cacti, like columns cut out by artificial means, and with dense thickets of the beautiful mezquite in numerous varieties. Here we also find groves of the stately fan palms (*Washingtonia Sonoræ*). But all this is only in places where the water is near the surface or where the rainfall is more constant. At the time of my visit many of these once so beautiful cañons were drying up and the trees were dying from lack of moisture. Trees which must have been several hundred years old were perishing because, as I was told, no water had fallen for four or five years and no floods to irrigate the bottom lands had come down for that length of time. Along the west coast there is even less vegetation in the cañons, and we travelled for hours and days without seeing anything but bare soil and here and there a few dwarf bushes. The soil is mostly glistening white, and the whole country looks as if modelled in clay. But let only a few copious rainstorms come and the barren ground will cover itself with a beautiful mat of flowers and green, and the branches of the shrubs will at once shoot out leaves. The whole country will then change in a few days from a barren waste to a paradise.

The promontory of the Santa Clara and Sierra Pintada requires a few words separately. Here the mountains are less basaltic and more volcanic, and accordingly the soil is deeper. The effect of this is that even in regions where the rain is very scant and irregular the vegetation is better. We find there miles and miles covered with a low and vigorous shrub, the *Torote*, which in places actually spreads over the ground as a kind of low forest. These torotes are most wonderful to look at. The trunk is enormous for the size of the tree. It branches itself close to the soil, and the many branches follow and rest on the ground for ten or more feet from the stem, the whole tree forming a large semi-globular bush of ten or more feet in height. If to this we add that each branch is almost as thick as the tree itself, and that it curves and bends itself like an immense snake, we can form an idea of the main vegetation on the slopes of this coast. These torotes stand at considerable distance one from the other, and, as they are low, they do not in the least hide the general outlines of the ground. Though small, these trees give considerable shadow—the only one that can be derived from the vegetation in these parts. At the time of my visit a rain had fallen—the first for several years—and while many torotes had already assumed their leaves, others were just in bloom. And lovely blooms they were, in clusters of beautiful lilac, with a sweet, delicate aroma, the whole bush appearing as a single clump of delicate violet lace. Along the seashore there is for several miles inland a low vegetation of dry and grey-colored bushes, seldom over two or three feet high. Most of these are so strongly aromatic that the mules refuse to eat them, even when they are dying from want of food. Only during the rainy season is it possible to find grasses and annuals in bloom. But very little rain is actually required to rejuvenate this arid country. As we look about us to the right or left, we find but barren plains, scantily covered here and there with low, dry-looking bushes. The *mesas*, or table mountains, which may be seen lining the horizon in this part of the peninsula, stand out boldly and sharply against the sky. On the side towards the ocean these mesas are steep and well defined, while towards the east or the sierra they are made out gradually in the general slope of the country. More towards the east the peaks of the sierras are seen, ragged and sharp—here like needles, there again as pyramids. None of these mountains are covered with sufficient vegetation to soften their outlines, the shrubs which are found being hardly large enough to be noticed until we are close upon them. In a general way the vegetation of this part of the peninsula resembles the barren parts of the Mexican mainland, and especially Sonora and Sinaloa. A large part of the genera are similar, but many, of course, are different, and peculiar to Baja California.

Of the animals met with in these parts there is here only room for a few remarks. We found on our trip to the country hares, rabbits, and deer almost every day. Ground squirrels and chipmunks are not uncommon, but not as numerous as in Alta California, this probably being due to the difficulty of burrowing through the basalt surface. But even the barrenest parts have their birds, and we could wake up every morning hearing the birds singing, even if there were nothing but tall cacti to be seen. In the tallest of these columnar and spiny vegetable monsters various species of wrens and other birds make their nests, partly protected from the attacks of snakes. Snakes and lizards are found everywhere if we look for them; but they are much less numerous than in the Cape Region, in which place they occur in countless numbers. If we turn over stones and fallen cacti we are nearly always rewarded by finding scorpions, spiders and centipedes of numerous kinds. If we search the rocks and sheltered places in the cañons we uncover heaps of shells of various kinds of land molluscs. Or, if we wait until the first rain falls, we may collect the same varieties of shells alive, crawling about over the rocks, only to disappear again when the shower is over. The size and variety of these Baja California land shells are simply wonderful. In color they are white, in size they range from half an inch to three inches or more. Every cañon, almost, has its peculiar variety, and every isolated mountain rewards the collector with new and interesting species. The great resemblance between the land shells of the barren plains of Baja California and Chile has often been pointed out, but so far no exhaustive comparative researches have been made. If such a connection between the two barren countries of the Pacific Slope could be established, it might point either to an ancient continuous barren climate extending from one country to the other, or it might indicate a succession of islands existing formerly some distance out from the shore of the Pacific. Such islands, if sufficiently far from the mainland, would necessarily be barren and dry and in no way partake of the tropical and exuberant nature of the Mexican and Central American mainland. Such islands would readily form the connecting links over which a fauna and flora could pass, even by the Equator, from one distant country to the other.

The great number of land shells found in these barren regions is simply marvellous. In some localities it would not be difficult to collect cartloads of them. We need only lift the stones to find them dead by the thousand. The live shells escape farther in, where it is difficult to follow them. But it is not alone the shells which are so plentiful in this dry country. As soon as the rain has set in and the country has got a general soaking, the whole nature changes as with the waving of a magic wand. The trees cover themselves with foliage, countless beetles, butterflies and other insects appear all at once and swarm everywhere. Every flower and every bush is a zoological garden, every pool an aquarium, every sheltered and damp nook is alive with snails dragging their turreted or rounded shells on their backs. But a few weeks of dry weather change all this. The insects die, the plants dry up, the snails seek their summer or winter homes, far in among the rocks. The bushes shed their leaves, the dust gathers, the rocks become heated, and the whole country assumes an aspect as if it had just been created out of white, dry clay. The biology of the mountains is slightly different. There we meet with taller trees, and even with forests. Springs are running all the year round, and a green vegetation is always found in sheltered and favored nooks. The eastern coast is much more densely covered with bushes or low trees, and as we ascend, even a few hundred feet, above the sea-level, the barrenness of the country is considerably modified. Yet we must not forget that in all this barrenness there are oases hidden among cañons so completely that they are not perceived until we are at their very border. But these places are generally cultivated ones. No water could be allowed to go to waste on wild shrubs and trees; every drop is, in a crude way, appropriated for irrigation and for the creation of palm groves and maize fields.

In Alta California the rain occurs during the most unfavorable season of the year; in Baja California it occurs during the most favorable season; and this difference in season is fully sufficient to explain the enormous vigor of animal and vegetable life which is so characteristic and manifest during the short periods of rain in the peninsula of Baja California.

6. SETTLEMENTS AND AGRICULTURE.—It is not my intention, nor is it feasible in this paper, to refer in an exhaustive manner to the possibilities of agriculture in Baja California; but as some readers will naturally ask, what, after all, this country is good for, a few remarks upon what actually exists may prove of interest.

Artificial irrigation exists only in comparatively few localities, and no great expense has anywhere been resorted to in order to supply water for irrigation purposes. The water is taken as it comes and wherever found. When it is running it is used up; when it is not running the plants are allowed to suffer. There are no large dams and no tunnels, and no great effort is made to keep the water back and to husband it in order that it may irrigate a few more acres. In only a few places, like Comondú and in San Ignacio, is the water supply said to hold out. In general it has been diminishing during the last fifty years. Thus at San Xavier we can see hundreds of acres which years ago were irrigated, but for which water cannot now be had. This may be due to diminished rainfall, as is the opinion of the people, or it may simply be the result of the destruction of the irrigation ditches made by the Padres. Remnants of such cemented ditches are seen in several places, but no apparent attempt is made to repair them. This lethargy is partly due to the fact that these irrigation works were constructed and maintained by Indian labor, free of cost. The Indians are now all dead; and as thus slave labor does not any more exist, the works of the *antiguos* are not repaired. Another reason is that the people are grossly ignorant and lack enterprise. This is the more important as population is not wanting. Nearly every family raises ten or more children, but as soon as the boys grow up they emigrate in order to seek for better surroundings in other countries. Then, again, the nature of the country is such that, even if an increase in production could be accomplished, it would be difficult to dispose of this product. There are no means of communication, and most of the produce must be consumed at home. There is no doubt but that with a comparatively small expenditure of money for the development and storage of water the productiveness of the country could be enormously increased. This increase will, however, not be likely to be brought about until some new impulse is given to the mining industries, which alone can employ a large number of men and families, who necessarily must become large consumers of food products. As far as I can see, there are few industries which can accomplish this but coal and coal oil. I am satisfied that in the near future both these products will be exploited in or near Baja California, as they are known to exist there in several localities.

Here a word or two may be said about the natural products, such as may be had without special cultivation. Foremost among these is the orchilla, a lichen growing on the stems and branches of low bushes along the coast. This orchilla looks like the gray moss found on trees in every country; it is a few inches long and resembles a gray beard. There are several kinds growing on the bushes, but only one species is valuable and worth gathering; and at the time of harvest we find camps of Mexicans here and there along the coast. When one place is exhausted the camp moves to another locality. In five years or so the orchilla has grown again enough to be ready for another harvest. The only danger that the orchilla will be finally exhausted is in the unscientific way of gathering. Along with the valuable variety grow one or two which are worthless for the production of dye. These varieties are allowed to remain untouched, and as a consequence they will multiply more rapidly, and finally will drive out the valuable kind.

Another source of income may be found in the agave, which grows in many localities. Its base is now used for the production of mezcal, but the fibres of the leaves are said to be strong, and may be used for the manufacture of ropes, etc. No effort has been made to utilise it for such a purpose. Another source of revenue may be derived from the inexhaustible banks of clams found on the coast. These clams were the chief food supply for the ancient Indians, who have thrown up the shells into veritable mounds, twenty or more feet high and miles and miles in length.

The trap blanket which covers the country explains the distances of the cultivated places from each other. These latter are generally several days' travel apart. They are, of course, only connected by trails, as there are no roads outside of the mining districts of the peninsula. But these trails are only trails in name, not in reality, as no work has been done on any of them except in the immediate vicinity of the villages. In many places the trails are so stony that the mules have to step over the boulders, and for miles and miles the progress is like that of a snail. We will now consider a few of the principal cultivated places in this part of the peninsula.

LORETO, once the most important town in Baja California, is now a mere hamlet of a few dozen houses. The ruins of the famous Mission are yet standing, and part of the church is used for service. The decay of the place dates back some thirty odd years, when the town was partly destroyed by an earthquake, followed some years later by a flood, which destroyed most of the houses and many of the plantations, even changing the course of the river. There are now only a few hundred inhabitants in all. There are several hundred date palms, and perhaps two hundred acres in cultivation in various crops. The date grows without irrigation on account of the nearness of the water to the surface. As far as I can learn, there is no export of any consequence—at the utmost a few small boatloads of dates, mezcal, hides, dried beef, etc.

SAN XAVIER.—The Mission church is the handsomest in Baja California, and is not equalled by any in Alta California. The style is Roman, and of great elegance and beauty, and the construction is of stone. The church is well preserved, and could, with little repair, last many hundreds of years more. It is the best-constructed Mission on the whole Pacific coast. Of the Mission part, however, little remains. These accessory parts, which were made of adobe, have long ago fallen. Of the irrigation works of the Padres little remains. There are several *pilas* or water tanks left, but the cemented ditches have fallen to decay, and water is now conducted in open earth-ditches. Consequently, many acres which were formerly irrigated are now dry. The people lay the cause to diminished rainfall. It is probable that they are partly correct; but certain it is that with some little work in saving the water and repairing the ditches much more land could be cultivated and irrigated. There are not over twenty-five persons now at the Mission, the guardian and his family constituting the largest part of the population. Perhaps fifty acres are under cultivation. We admire many large olive trees, which must date back to the first settlement by the Padres. There are also fine old Mission fig trees of enormous size. The olives belong to at least three distinct varieties. Oranges, cane, maize, beans, bananas and other tropical fruits do well. San Xavier is a lovely spot, an oasis in the desert; but shut up as it is in a narrow cañon, perhaps a thousand feet wide, it is subject to great heat, and can only be agreeable as a dwelling-place during the cooler part of the year.

In the vicinity are a number of primitive distilleries for aguardiente, which is exported to other parts of Mexico.

COMONDÚ.—This place is one of the best known in Baja California. There are two settlements in the arroyo, about three miles apart. The lower place, where the town proper is situated, is known as San Miguel de Comondú; the upper part, where is the Mission, is called after the church San José de Comondú. The Mission is now mostly in ruins, and of the church there remains only the shell. The inhabitants told me that the Government some years ago ordered the church sold as bricks to any one wishing to buy. As a consequence, little now remains of this once beautiful though small church. A single room in the Mission is yet used for service. The whole valley of Comondú is irrigated from two large springs. Some thousand acres are under cultivation, and the orchards and fields extend some seven miles down the cañon. This arroyo opens out in the lagoon of San Jorge, known as the *estero.* The place known as San Jorge is not situated in an arroyo. Comondú is eight leagues from the Pacific and eighteen leagues from the Gulf. The arroyo in which Comondú is situated does not come from the sierra, but rises in the plains. The irrigated part is a forest of palms, fig trees, oranges, lemons, olives, vineyards, etc. I was told that the following figures of the production of this beautiful place are fairly correct: dried black figs, about ten thousand arrobas; raisins (*pasas*), about two thousand arrobas: dates, about two thousand arrobas. There are about 1,600 date trees. Some three thousand arrobas of panoche, or raw sugar, are produced. The figs, as well as the raisins and dates, fetch, as a rule, 50 cents the arroba. They are packed in rawhide bags and transported on muleback to Mulejé. During our stay we found great hospitality in the home of Don Francisco Rodrigues and Doña Josefa Romero, to whom I am indebted for the above information. There are about four hundred inhabitants in the two places.

PURÍSIMA.—From Purísima to the Pacific Ocean there are about eight leagues; to the Gulf, eighteen to twenty leagues; to San José de Gracia, about forty leagues. From Purísima one trail runs to Mulejé over the mountains and to the Gulf, while another trail runs along the western coast to the Estero El Ranchito, or, as it is known on the American maps, the San Ignacio Lagoon. The arroyo of Purísima is one of the largest in Baja California, and one of the best watered. The water is permanent at the point of the settlements, and with care many times the present extent of land could be irrigated. Now there is irrigated a strip of land thirteen leagues long and from a quarter of a mile to more in width. Our host, Don Trinidad Mayoral, and his son, Don José Mayoral, gave me the following information as regards products. Panoche, or raw sugar, is only produced for home use. There are exported about 7,000 arrobas of raisins and 8,000 arrobas of dried figs. These are of the black kind, known in California as the Mission, and are of superior quality, but they are poorly handled. They are much sweeter than any produced in California. It is interesting to note that it is principally the first crop, or the *brebas*, which is dried. When the water is low (in years with little rainfall) the stretch of land irrigated is reduced to five leagues. There are few dates grown in Purísima. This is due, in my opinion, to the shallowness of the soil, which seems to be underlaid by hard-pan. It is this very hard-pan which causes the water to remain so long in the river-bed, and forms the bottom of the water-holes.

There are, perhaps, two hundred and fifty inhabitants in the settlement of Purísima.

Purísima is famous for its many water-holes. In the rainy season, and when the rain is falling, sufficient water comes down in the river to form a continuous stream all the way to the ocean. But as the rain stops and as the season advances the water becomes less and less, and would soon go down to almost nothing but for the many water-holes, which stretch along for many leagues. They are of all sizes and depths, but generally they are quite large. Many are several hundred feet across, and are said to be a hundred feet or more deep. The natives believe them to be bottomless. At my visit at the end of the dry season the holes were all connected by a small stream of running water, and seen from a distance it appeared as if we had before us an immense river—immense for this country at least.

In the deep and cool water-holes we find fishes and terrapins, or, as the latter are called there, "ahuamas." The species is of much larger size than any found elsewhere in Baja California outside of the ocean.

The Mission church is the poorest and smallest I have seen in the peninsula. It is in fair preservation, but offers nothing of any interest as regards its architecture—a mere small rectangular building, without towers or ornamentation.

San Ignacio.—This is by far the largest place in the central part of the peninsula. There is a fine old Mission and church, but not as well built as the one at San Xavier. The arroyo is irrigated from a few large springs, and so abundant is the water that it runs for miles down the cañon and forms ponds here and there. There are about 60,000 date palms divided among the many settlers. The number of inhabitants must be at least one thousand. Hardly anything but dates is grown. Nearly all the dates are exported by mules and burros to Santa Rosalia. Most of the crop is distilled into aguardiente, and what is not distilled is sold on the mainland of Mexico.

A word needs to be said about the quality of the products. The soil all over Baja California consists of an ashy loam of volcanic nature, evidently deposited from volcanoes in a shallow ocean and gradually elevated. It is of great richness in mineral matters, but, except in a few localities, poor in humus. The quality of the fruit and cereals, etc., grown in this soil is very fine, though no good varieties have been introduced. The grapes, dried into raisins, are of the "Mission" variety—a bluish-black grape—very sweet, but otherwise unsuitable to raisins. The seeds are small and the skin is thin, but as the grapes are small the raisins can in no way compete with the Muscats grown in California. The dates are perfectly at home, and wherever a seed is dropped in a moist place it soon grows and fruits, but the quality of the variety is poor. It seems to me that the date grown everywhere in Baja California belongs to some ancient, wild stock. It certainly is different from any of the better Arabian or Persian dates imported to California. The meat is coarse and stringy, and the seed is simply enormous, just like that of the Canary Island species. This date is not particularly sweet, and it cannot compare with better varieties from Africa. There are two or three kinds, all with enormous seeds. One variety is very dark, while one is light yellow. A kind growing at the Mission of Los Dolores is said to be a free-stone to such an extent that the dates can all be pulled from the cluster, while the seeds remain attached to the stems. But these coarse dates seem to me to be extremely valuable for cooking purposes. The time to use them for this purpose is when they are nearly ripe but yet hard. If boiled with meat, they are then very palatable, imparting a fine flavor to the dish. I think that an industry of canning dates would be profitable.

The figs grown in Baja California are superior to those grown in any part of the United States or in Sonora. They are larger and sweeter, and also better flavored. But so far only the black Mission and a worthless fig with white skin and large seeds are grown, and no effort has been made to introduce finer varieties, and no one seems even to know that there is anything better to be had. Under such circumstances the prospect of improving horticulture in Baja California is not promising. What is said here about fruit holds good also as regards grasses and vegetables. In every settlement there are waste lands soaked with water through seepage. Instead of planting useful grasses in such places we find nothing but weeds and the bitter *Yerba mansa*, which is useless for pasture. With stock-raising it is very much the same. During a succession of rainy years the cattle thrive well, only to die in years of little rain. This, of course, may not be the fault of the people; but I think that some grasses might be introduced which would require less rain. The Australian salt bushes, and hundreds of other plants, might prove a boon to the country.

As regards the people, it can be said that they are very friendly and hospitable, and if treated right can be depended upon. There is not the least danger to any one, and even the most inexperienced traveller need have no fear, as robberies and murders are unheard of. The inhabitants of Baja California compare very favorably with those of any other country, and their backwardness must in a great degree be ascribed to the extreme isolation of the peninsula and to the relatively small part of the land capable of cultivation.

7. THE PLACER MINES OF SIERRA PINTADA.—As one object of my journey was to study and report on the placer mines known at that time as the Santa Clara diggings, a few words about the country where they are situated may prove of interest. The promontory, or peninsula, in which these mines are situated is separated from the mountainous region around San Ignacio by a vast plain, which in a recent geological period must have been submerged. At that time the Santa Clara and Sierra Pintada Mountains formed a succession of islands, of which Cerros and San Benito Islands are the continuation and the remnants. The Santa Clara range was separated from the Sierra Pintada, and both were separated from the islands further west. There is now no forest on any of these mountains, and water is extremely scarce. Since the discovery of gold several springs, not formerly known, have been found, and it is probable that several more exist. The mountain peaks are about

3,000 feet high and much broken. In the Santa Clara region the peaks are pointed, while in the Sierra Pintada they have the shape of table mountains, with here and there a few sharper *picachos*, or peaks. The gold in the placers is found in a stratified deposit of coarse white, ashy soil. The mountains themselves are built up of volcanic ashes, stratified and overlaid by lava and, to some limited extent, by basalt or trap. On account of the absence of running water, all the gold is recovered by the dry-wash, that is, it is separated by screens, the dusty soil being fanned away, the heavier gold remaining. At my visit the main settlement was at a place called San Andrés, a few miles from the landing-places of San Roque and Asunción. Here wells have been dug to the number of a dozen or more, at the foot of a mesa, and the water was hoisted out and sold at one real (12½ cents) a burro-load. About 1,000 gallons were thus taken out in a day. The water was carried in 20-gallon kegs on burros to the placer mines situated some sixteen to twenty-five miles away in the mountains, where it fetches 1 real the gallon. The gold region is between lat. 28° and 27°, and mostly on the west side of the Sierra Pintada.

At San Andrés we found some two dozen tents, and one house made of lumber. At the mines there were nothing but tents. Some one thousand men had been at the mines at one time, but at my visit there was not half that number. Everything is carried to the place by small schooners or by mules from San Ignacio. But on account of want of water and food, most of the mules die or are made useless in a few weeks, and so far no one had made any profit in hauling goods. Everything is dear, and I had to spend twenty-five dollars in feed and water a day for my four mules. A sack of flour was worth eight dollars, and so on. The price paid for the virgin placer-gold was thirty-two dollars per ounce. There is plenty of gold in the gravel, but on account of the slow process and the time consumed in fanning it out a man would only average two to four *adarmes** of gold a day. One *adarme* is worth about $2 silver. So far, only about 75,000 dollars worth of gold had been taken out *in all*. It will thus be seen that only those content with the very poorest wages can be satisfied with the diggings. Many of the miners were Indians from the mainland. The rest were Mexicans from the mainland and the peninsula. Only one hundred Americans had been to the mines at one time. More miners had returned than were remaining. Still, it is my opinion that these placers will be worked for many years to come by Mexicans, satisfied with gaining a net profit of from fifty cents to one dollar a day. The placers were rediscovered in the summer of 1898 by some Mexican miners. There had always been rumors that in former years, during the time of the Missions, the Padres had received large quantities of gold from this region, through the Indians. At the time of my visit there was no one to collect a tax on the claims, and any one could dig wherever he pleased. If there had been running water for washing the gold, there is little doubt but that these mines, which now pay so poorly, would have been famous and immensely profitable.

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* The *adarme* is the sixteenth part of an ounce.

The climate of the promontory, including the Santa Clara and Sierra Pintada mountains, is not by any means as mild as might be expected from its southern latitude. Fogs are persistent during the spring, and high winds are not uncommon. Miners who did not provide themselves with heavy covering have complained of various ailments—rheumatism, etc. The situation of the promontory is such as to catch all the fogs and high winds which pass down the coast with the northwest trade winds. The low desert plain situated between the coast mountains and the sierra favors a draft, which causes the winds to sweep over this country with unusual force. The promontory, which runs in a direction north and west, consists of at least two distinct mountain ranges. The southerly one is known as the Sierra de Santa Clara, while the more central one bears the name of Sierra Pintada. The two ranges are connected by low hills and by table mountains. Seen from a distance, one can readily make out that the two ranges or sierras are quite distinct. The placers were at first called the Santa Clara placers, but little by little the name of Sierra Pintada seems to have been adopted. As a fact they are not situated in the Santa Clara range, but in the Pintada.

When I was in the region a large number of copper claims had been located, and some ore proved to be very rich; but it remains to be seen if it can be mined, the scarcity of water and fuel being the main difficulties. The fuel question may be solved by the importation of anthracite coal from Sonora; but it is difficult to see how water can be procured where natural springs are so few and so poor in quality. Near the shore-line water may, however, be had almost anywhere by digging shallow wells. Such wells have now been dug both at San Roque and at Asunción. But they are situated on the very beach, and would be too far distant from the mines.

8. MOUNTAIN PEAKS.—As has been already stated, the central part of the peninsula is traversed by a sierra or mountain chain, from which rise a large number of sharp and beautiful peaks. This main

sierra is situated much closer to the Gulf coast than to the Pacific. On the maps which have been published only a few of these peaks are indicated by names. In order to supply this want I tried to ascertain the correct names of as many peaks as possible, though I had only opportunity to ascend one or two of the lower ones. I have marked these names on the map, the spelling being that used in a Mexican Saints' Calendar. The elevations given are those marked on the U. S. Hydrographic Charts Nos. 219, 220, 221, and are only approximately correct.

Beginning in the south and proceeding northwards, I ascertained the names of the following peaks visible from the coast or from the trails along which we passed:

San Francisco, 1,578 feet, west of San José island.
San Miguel, 2,514 feet, west of Habana island.
La Cafetera, 2,118 feet, west of Sta. Cruz island.
Alta Gracia, 4,773 feet, west of Danzante island.
La Palmilla, 4,660 feet, west of Puerto Escondido.
Tabor, 4,151 feet, west of Carmen island.
Victoria, 3,756 feet, west of Carmen island.
Las Parras, 3,674 feet, west of Loreto and immediately north of the road to Mission San Xavier.
Carrizal, 4,148 feet, north of Las Parras.
Agua Verde, 4,920 feet, north of Carrizal.
La Giganta, 5,794 feet, north of Agua Verde.
Los Encinos, —— feet, north of La Giganta.
Las Cruces, —— feet, north of Los Encinos.
Carrizal, 2,716 feet, north of Las Cruces.
Guajademí, 3,943 feet, west of Concepción Bay.
Zacatecas, 3,710 feet, north of Guajademí.

The last two are the most prominent peaks in this region.

Passing in a half-circle to the north towards Santa Rosalia and Las Virgenes, the following peaks are situated almost in the centre of the peninsula, and are probably seen from both the Gulf and the Pacific Ocean:

San Vicente, 3,890 feet, west of Guajademí.

San Joaquín, —— feet, west of Guajademí and Zacatecas.

El Valle, 4,212 feet, at the head of the arroyo San Juan.

Las Cañadas and Las Palmas, both very prominent peaks, north of El Valle and at the head-waters of San Juan and San Pedro.

El Puro Año, 5,828 feet. This is the highest mountain in the central part of Baja California. The whole mountain chain on which this and many other peaks are situated is known under the general name of Sierra de las Palmas.

Las Palmas is generally supposed to extend from the vicinity of San Pedro, in the north, to El Valle, in the south. From El Valle southwards the sierra is known as Sierra del Valle.

San Pedro. A very high cluster of peaks, situated north of El Puro Año and east of Patrocinio, and at the head-waters of San José Magdalena, which latter arroyo opens in the Gulf.

San Tadeo, or El Pilón de San Tadeo. A most remarkably-shaped peak, situated north of San Pedro, and sufficiently isolated to be seen from many sides.

La Trinidad. A prominent peak north of San Tadeo.

Santa Isabel. A cluster of peaks or sierra, of which La Bandera is the highest point. La Bandera is not a sharp peak, but a high, rounded crest which, when seen from the west, has something of the shape of a flowing banner; a sharp peak at its very northern end, recalling the staff of the banner—hence the name. It is uncertain which of the peaks marked on the map is intended for La Bandera, but it is possibly the one marked 5,202 feet. It must be remembered that only a few of the more prominent peaks were measured by the U. S. Government Survey and marked on its charts.

Santa Maria. A peak east of the Cerro de la Bandera, situated at the head of a large arroyo of the same name and flowing into the Gulf.

La Ascensión. A high sierra north of La Bandera.

Santa Cruz, north of La Ascensión.

Santa Lucia, north of Santa Cruz. North of Santa Lucia there is a great depression in the sierra, through which leads the road to Santa Rosalia.

San Ignacio. North of this pass we have the beautiful mountain complex known as Las Virgenes. This consists of three prominent peaks—Las Tres Virgenes. The central one of these is an extinct or semi-extinct volcano, known as El Volcán. It is said to give off at times strong sulphur fumes and a number of steam geysers, indicating that the internal heat is not quenched.

Cerro Colorado. A reddish-colored mountain immediately north of San Ignacio.

Picacho de Santiago, 3,764 feet, is the most prominent peak north of San Ignacio, and can be seen from that point.

Sierra de San Francisco. This is the very highest sierra seen to be situated north of the Picacho de Santiago.

Natividad. An isolated mountain peak, situated well out on the plain west of Picacho de Santiago.

It may not be inappropriate to state that in Mexico, and especially in the peninsula of Baja California, a "sierra" is an isolated mountain, which is separated from its neighbours by deep cañons and plains or by lower hills. Thus, the mountain chain from one end of Baja California to the other is a succession of different "sierras," each one of which possesses a different name. A general name for the whole mountain backbone is not in use. In Alta California the continuation of this backbone is known by one name—Sierra Nevada—but in Baja California no such general name is in use.

As regards the geological formation of the mountain peaks little is known. From my own few observations, it appears that the majority of the peaks consist of granite, their sides being covered with a blanket of trap. At one place, where the trail passes the foot of the peak, Las Parras, on the road between Loreto and San Xavier, a most interesting geological formation was observed. Enclosing the pass are immense walls of trap, beyond which the granite peak is visible. On the south side of the pass, at its highest point and close to the road, I found this trap rock to be full of large and small veins of granite. One of the largest veins could be distinctly followed for several hundred feet up toward the granite peak; and there can be no doubt about the nature of the vein. In this instance the granite is, accordingly, of very recent formation, having in a liquid state filled cracks in the trap rock instead of *vice versa*, as is generally the case. The granite veins are distinct and well defined, and their proximity to the main trail through the pass will make it easy for any one interested to verify this statement as regards their nature.

The immense trap covering, which has spread over the central part of Baja California, has been referred to several times in this paper. It must have been of a recent geological time, probably of the same age as in California. The arroyos or water-courses must have had previous to the great eruption of trap, to some extent, the same position as now. The walls of the present arroyos—at least many of them—consist of trap rock, hundreds of feet thick. Towards the mesas this rock diminishes in thickness, and it appears plain that the thickness in the arroyos is due to the fact that the eruptive trap followed previous depressions and arroyos, which, to a great extent, coincided with the present ones.

To this rock is due the formation of nearly all the mesas, so very characteristic of the region. The hard trap has protected the underlying layers and prevented erosion. The nature of the cañons and arroyos is also due to this rock. Nearly every arroyo is lined by perpendicular walls of blackish trap, forming a smooth and even rim at the top—the natural border of the mesa.

9. LAGOONS OR ESTEROS.—EL RANCHITO.—This is the large lagoon is marked on the U. S. Government maps as San Ignacio Lagoon. This latter name is not recognized or even known in Baja California, and when I inquired for such a place no one understood what was meant. The lagoon, as well as the whole of the surrounding country, appears to be in a state of elevation—the lagoon itself becoming smaller and smaller even during recent years. The sandy plains around it, which occupy an immense territory, appear to have lately risen from the Pacific.

EL COYOTE.—This is the name of the next largest lagoon of this part of the country near San Ignacio. It is situated a little to the west of El Ranchito, and is only one-third as large as the latter.

OJO DE LIEBRE.—This is the real name of the large lagoon known in the United States maps as Scammons Lagoon. This latter name is not used by the inhabitants of the country, and is not even known, except to a few sea captains who have had the use of the United States maps. The Mexicans do not use the name laguna (lagoon), but designate these three lagoons simply as El Ranchito, El Coyote and Ojo de Liebre. The lagoon known as Black Warrior Lagoon is so named after a vessel which was stranded there many years ago. The Mexican name I could not ascertain.

10. POSSIBLE COLONISATION OF THE PENINSULA.—One of the first questions asked by those who are interested in the agricultural improvement of the peninsula of Baja California relates to the possible colonisation of the country by foreign immigrants. So far many efforts have been made to induce settlers to come and develop the latent horticultural resources of the country, but nearly, if not all, of these have failed of success. It is but natural to think that a territory so immense as that of Baja California should possess many places sufficiently productive to induce and attract agriculturists from abroad. I think the chief error committed has been that of self-deception and an over-estimation of the constancy of the rainfall of the peninsula. In the foregoing pages I have endeavored to show that while the rainfall is at times sufficient or even abundant for the raising of crops, periods of drought are so frequent that no reliance should be placed on the constancy of the rain. Every colonisation enterprise in the peninsula has been started during or after a period of unusual precipitation, and, similarly, rain has failed during a following period of drought. People visiting Baja California during years of good rainfall can hardly help being struck by the productiveness of the country and the salubrity of its climate. Ignorant of the true climatic conditions, which are sure sooner or later to manifest themselves, they suppose that this fertility is recurrent yearly, when in fact it should be rated as an exception. The rolling hills, which for a year or two will produce splendid crops of grain, are almost certain to remain barren for several years following. From this it follows that no crops are assured which rely upon the natural precipitation alone. In the mountains there are, of course, yearly and sufficient rains, but on account of their distance such places are for the present unsuitable for permanent settlement of agriculturists. But the water which falls so freely in the sierra might be used elsewhere in the form of irrigation; and this alone can make agriculture a permanent success on the peninsula. As all springs and streams of any importance have already been occupied and utilised for this purpose, it is evident that some other means must be resorted to in order to extend the

settlement of the country. Even a casual observer will see that wherever irrigation is practised it is of the very crudest kind. Nowhere are any large and permanent dams made, nowhere is the land terraced or even levelled, and nowhere do we find any cemented ditches which would husband the water while carried from one place to another. There is certainly not a single water-course in the peninsula which could not be made to treble or quadruple its irrigation capacity through the construction of proper irrigation works. In order to make any settlement a success, the first requisite is the construction of such irrigation works, and agriculturists should not be induced to settle there until such works have actually been constructed and put in operation. The procuring of land suitable to agriculture is the least difficult part. There are hundreds of large arroyos all over the peninsula which offer the choicest bottom-lands to the irrigator, but until dams and ditches are in operation even the choicest of these lands will remain unsuitable for settlement. In many places water for irrigation may be had by pumping; but as wood is scarce, and as oil and coal are not yet utilised, this manner of raising water cannot be resorted to at present. Irrigation works can only be constructed by rich corporations and by Government aid, and the motive which will induce such constructions will be the profit to be derived. This question of profit is one that will be answered differently according to circumstances,as what will not pay to-day may be highly profitable to-morrow. The exploiting of oil, coal and minerals of various kinds, in which Baja California is indisputably rich, will no doubt in time create a demand for supplies which can best be procured in the immediate vicinity where they are needed. When such time comes—and in places it has already come—then there will be profits in the expenditure of money for irrigation works, and settlers will not be disappointed in their expectations. The geniality of the climate of the peninsula is so unsurpassed that it alone should attract the attention of the world. While no one can live on climate alone, as the saying is, it is not less certain that climate, land, and irrigation will in time combine to make Baja California a desirable place for settlements.

11. APPROXIMATE DISTANCES FROM LA PAZ TO SAN IGNACIO BY THE CENTRAL TRAIL.—

La Paz to Zacatal, 1 league.
Zacatal to Arizpes, 2 leagues.
Arizpes to Quelelé, 2 leagues.
Quelelé to Rodriguez, 2 leagues.
Rodriguez to Cajon de los Reyes, 1 league.
Cajon de los Reyes to Mesa de la Vieja, 5 leagues.

Mesa de la Vieja to Cerro Colorado, 1½ league.
Cerro Colorado to Arroyo de San Hilario, 2 leagues.
Arroyo de San Hilario to La Junta, 2 leagues.
La Junta to Arroyo de San Gregorio, 2 leagues.
San Gregorio to Cerro de los Liebres, 3 leagues.
Cerro de Los Liebres to Arroyo Iritú, 5 leagues.
Iritú to Plátano, 2 leagues.
Plátano to San Luis, 2½ leagues.
San Luis to Frijol, 2 leagues.
Frijol to Ranchito (situated in the same arroyo), 1 league.
Ranchito to Tepentú, 5 leagues.
Tepentú to Batequitos, 2 leagues.
Batequitos to Los Cerritos, 3 leagues.
Cerritos to Arroyo del Quepo, 4 leagues.
El Quepo to Jesus Maria, 4 leagues.
Jesus Maria to Aguajitos, 3 leagues.
Aguajitos to San Rafael, 1 league.
San Rafael to Posa Miguel, 5 leagues.
Posa Miguel to San Lucas, 5 leagues.
San Lucas to Posa Teresa, 4 leagues.
Posa Teresa to San Francisco Xavier, 5 leagues.
San Francisco Xavier to Santa Rosalia, 3 leagues.
Santa Rosalia to El Quiñí, 2 leagues.
El Quiñí to Comondú, 2 leagues.
Comondú to San Vicente, 7 leagues.
San Vicente to La Purísima, 2 leagues.
La Purísima to Purísima Vieja, 2 leagues.
Purísima Vieja to El Paso Hondo, 2 leagues.
Paso Hondo to San José, 3 leagues.
San José to Guajademí, 5 leagues.
Guajademí to El Potrero, 4 leagues.
El Potrero to Mulejé, 10 leagues.
Mulejé to San Marcos, 9 leagues.
San Marcos to San Bruno, 3 leagues.
San Bruno to San Lucas, 2 leagues.
San Lucas to Santa Rosalia, 2 leagues.
Santa Rosalia to San Xavier, 2 leagues. (Not the Mission San Xavier.)
San Xavier to Santa Cruz, 3 leagues.
Santa Cruz to San Ignacio, 10 leagues.

12. Distances from Mission San Xavier to San Ignacio by the Western Trail.—

San Xavier to Comondú, 9 leagues.
Comondú to Pabellón, 2½ leagues.
Pabellón to San Vicente, 2 leagues.
San Vicente to Purísima, 2 leagues.
Purísima to San José, 4 leagues.
San José to El Mezquital, 5 leagues. (No water.)
El Mezquital to San Juanico, 2½ leagues.
San Juanico to Carrizal, 2½ leagues.
Carrizal to Cadejé, 1¼ league.
Cadejé to San Raymundo, 2 leagues.
San Raymundo to San Juan, 2 leagues. (No water.)
San Juan to Los Dolores, 1½ league. (No water.)
Los Dolores to Arroyo de las Vacas, 1½ league.
Las Vacas to San José de Gracia, 1 league.
San José de Gracia to San Benito, 3 leagues.
San Benito to Patrocinio, 2½ leagues.
Patrocinio to Jesus Maria, 3½ leagues.
Jesus Maria to San Joaquín, 8 leagues.
San Joaquin to San Ignacío, 2 leagues.

12. Distances from San Ignacio to Calmalli (variously spelled Calamajé, Calamujé, Calamahi).—

San Ignacio to San Juan, 2 leagues.
San Juan to Higuera, 2½ leagues.
La Higuera to Natividad, 1½ league.
Natividad to San Estéban, 1 league.
San Estéban to Ascensión, ½ league.
Ascensión to San Pablo, 8 leagues.
San Pablo to Santa Gertrúdis, 5 leagues.
Santa Gertrúdis to Arroyo del Cerro, 4 leagues.
Arroyo del Cerro to Campo Aleman, 9 leagues.
Campo Aleman to Calmalli, 2 leagues. (This name is of Indian origin.)

14. Distances from San Ignacio to San Roque.—

San Ignacio to San Angel, 5 leagues.
San Angel to Tinaja de Santa Clara, 15 leagues.
Tinaja de Santa Clara to San Lorenzo, 3 leagues.
San Lorenzo to Cerro Prieto, 10 leagues.
Cerro Prieto to San Rafael, 5 leagues.
San Rafael to Los Placeres, 5 leagues.
Los Placeres to San Andrés, 6 leagues.
San Andrés to San Roque, 4 leagues.

15. Places on the Direct Road between San Lucas and La Paz.—

Cabo San Lucas.
La Mojonera.
El Tulí.
El Bledito.
Cerro Colorado.
Matancita.
Pozo de Gonzales.
Cerro Blanco.
Palmilla.
Salate.
San José del Cabo.
Santa Rosa.
Zacatal.
San José Viejo.
San Bernabé.
Catalina.
Las Veredas.
San Joaquín.
San Pedro.
Agua Verde.
Santa Anita.
La Laguna.
El Desecho.
Salto.
La Palma.
Caduaño.
Miraflores.
El Chinal.
Cuesta Blanca.
Juamuchilár.
Matancita.
Santiago.
La Capilla.
Mesa del Cuero.
Buena Vista.
Tecolote.
Piedras Gordas.
Ensenada de Palma.
Los Cantiles.
Palo Blanco.
Coral Viejo.
San Bartolo.
Rodeo.
Agua Blanca.
San Antonio.
El Triunfo.
San Pedro.
La Paz.

16. Places from San Jose to Todos Santos.—

San José del Cabo.
El Encinalito.
El Guayabo.
El Tulí.
Las Parras.
San Miguelito.
La Mesa Verde.
Candelaria.
La Calera.
Los Encinitos.
San Jacinto.
Palmar del Medio.
Pescadero.
Los Lobos.
Todos Santos. (Not to be confounded with the Todos Santos bay, situated near Ensenada, in the northern part of the peninsula.)

THE LAPPS OF SWEDEN.

BY

E. D. WINSLOW, STOCKHOLM.

In the northern provinces of Sweden and Norway live the Lapps. In many districts and communities they constitute the majority of the population by a large degree; yet, like the Indians on our former western borders, the Lapps show signs of a sure disappearance. The march of our modern civilisation has already set in towards the far north, the wealth of the mines is beginning to be sought, and contact with the white man seems to alarm the sturdy little nomads of the Arctic Circle. In the year 1885 the population of the Swedish Lapps was given out officially as 5,955; while in 1895 the latest figures obtainable indicate that this number has sunk to 5,576.* The County Boards, who have compiled these figures, do not give any reason nor explain in any way the cause of the diminution of the population of the Laplanders. I compare them to our Indians in many things. Like them, they do not till the fields nor live in houses. They subsist chiefly on fish and the flesh of the reindeer. In the winter they live in snow-constructed protections, and in summer tents of skins, with an opening at the top for the escape of smoke, keep them comfortable according to their notion.

The Government wishes to protect the Lapps and at the same time not to interfere with the development of the country and the opening up of that vast region in the Arctic Circle filled with iron, copper and other minerals. Railroads now pierce the former unknown tracts, mines are being developed, prospectors are searching for new treasures, and new cities are springing into life.

The Lapps are short of stature, with high cheek-bones, and seem closely allied to the Mongolian type of mankind. Their wants are few, they are semi-civilised, and the progress of the world at large is of little consequence to them. The Swedes, Norwegians and Finns are supplanting them.

The Swedish Government has enacted laws which apply directly to the Laplanders, and which it was thought would protect them in their rights and privileges. Since the year 1886 there has been in force a law passed by the Parliament, setting aside a certain territory in the extreme north for the use of these interesting people. Sections of this territory were to be theirs, for their reindeer and for their homes. But, as with us in the case of the Indian, the County Boards have been continually at work endeavoring to curtail the effect of the law and to hinder its enforcement.

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* The Swedish Lapps numbered in 1890, according to the *Almanach de Gotha* for 1900 (p. 1101), 6,846. An exact return of such a population is hardly to be expected.

Civilisation cannot exist with semi-civilisation; tilled fields and herds of cattle cannot be neighbors to untilled wastes and droves of reindeer. The wealth of the Lapp consists of his reindeer, and the beast does not seem to thrive as a wholly domestic animal. It is estimated that there are nearly 200,000 reindeer in Sweden alone. The animals are moved about from place to place—in the mountains during the summer and into the valleys during the winter. They rest no long time in one place, and are continually on the move. They are the buffalo of Sweden. The hide clothes the Lapp, the flesh feeds him, the milk furnishes him with cheese, and the young animals draw his sleighs.

The Government has its little problem to solve. It wishes to be just to all its people and yet not hinder the onward movement of civilisation. The proper protection of this good and harmless people is a serious question. To own and raise reindeer is not compatible with the life of the homesteader. The building of railways and the development of mines soon destroy the hunting-ground of the Lapp. The harnessing of the waterfalls, in which this northern country abounds, will destroy the fish.

It would seem almost certain that the Lapp is doomed to extinction, notwithstanding the care and protection that the Government is endeavoring to give him. With his departure will go an interesting member of the human family. He has lived on about the only part of the earth's surface that was the most uninviting. It has been thought possible to move them in colonies to Spitzbergen; but reindeer cannot exist on that island. Science, if it wishes to acquaint itself with the Lapp, his work and daily life and his language, must make the researches without any loss of time, for he is slowly being absorbed, his individuality is disappearing, and the characteristics of the race and the language will soon be found only in history.

EXPLORATIONS IN THE RUBBER DISTRICTS OF BOLIVIA.

BY

BARON H. ARNOUS DE RIVIÈRE.

In the year 1892 I wrote an article for the Geographical Society at the request of Judge Daly, president of said Society, upon my explorations in the Beni Province of Bolivia. That province, so long unknown, and yet containing so much treasure, had never been thoroughly explored, and there were no maps to be referred to.

The principal object of the paper was to give an approximate description of the country and some maps indicating the course of the rivers, showing the necessity of cutting a road between the Beni and the Lake Titicaca.

At that time the main interest was the working of the gold gravel in the rivers and the culture of the *Calisaya* (quinine bark). This last culture was losing its importance more and more every year, because the quinine trees were getting scarce by the destructive way of cutting them down used by the Indians, and the planters were discouraged and gave up planting the trees when it was shown that the calisaya in India was yielding to the English its bark at a lower rate in production and freight.

As for the gold gravel, it was not worked to any extent, as the different enterprises had never been backed by sufficient capital or competent men. No attempt had been made to work the quartz veins, save, perhaps, in Poto, in the Cordillera north of Lake Titicaca, and in Carauaya, which is now a marvellous gold-yielding district, easily reached by the road leading from Juliaca to Azángaro and Sandia.

But it became rumored by those who were clearing the forest that gum trees (caoutchouc) were abundant and were wantonly cut down by the Indians and the settlers, who knew not how to extract the gum without killing the tree. Carlos Peña, who was working the hacienda of San Antonio, on the Villianoa stream, was, I believe, the first man on the Mapiri river who smoked the gum. The smoking is done by lighting a fire of the very fruit of the tree, which gives a dense smoke. The liquid gum is then spread on a wooden shovel in the form of a pancake and presented to the smoke. The pancakes, when well daubed with soot, are piled up one upon another until they form a mass weighing from 75 to 80 pounds, which is wrapped up in rawhide or heavy canvas. The smoking must be done within two or three days of the collecting or the juice granulates. The samples thus sent by different owners of the gum trees were a success, and all at once there was a demand for all that could be gathered.

The cutting down of the trees was strictly prohibited, and all along the Mapiri river and the Beni the Indians began tapping the trees and selling the gum in Sorata.

In Churumani, the big hacienda belonging to Sr. Goitia, Senator for La Paz, the calisaya (quinine) was almost abandoned, and all the labor directed to the gum.

The bark of the best Bolivian quality, treated in Europe, never gave more than eight per cent. of sulphate of quinine. It seems strange that no effort has ever been made to extract the sulphate in the country where it is produced, thus avoiding the payment of heavy freight on 92 per cent. of dead weight, besides damaging the quality by fermentation on the sea.

This is more remarkable when it is known that a great deal of sulphate is shipped from Europe to South America, where it commands a heavy price, Bolivia being the main producing country.

As soon as it was known that the house of Brayard had settled on the Madre de Dios, another French house (Devez) established itself lower down on the Mamoré, and later a German firm occupied Ribera Alta. The difficulty first encountered was the scarcity of hands, the Indians being very uncertain and unsteady—so much so that without giving any notice they would leave and float up or down the river on logs before their contract was at an end. The only way to keep them was to allow them to run in debt at the company's storehouse and to keep a guard who would watch and prevent their running away. But some of them, having managed to escape, told the northern Indians that it was not safe for them to navigate the river below the establishments, as they would be seized and turned into slaves.

All the gum obtained was shipped down the Mamoré and the Amazon, consigned in Pará and went to the European and United States markets under the name of Pará gum, when in reality it was Bolivian gum. It is difficult to understand that a product so easily packed, and in such demand, should be made to travel over three thousand miles, most of it through a country foreign to the production.

Both the railroads, that from Antofogasta to Oruro and the one from Mollendo to Puno, have their termini only a hundred and fifty miles from the gum-producing country, and yet no serious effort has been made to build the proper roads from the Beni to the Pacific.

It was under those circumstances that in the year 1893 a company was formed with a capital of $500,000, its object being to secure a Gum Alliance and to build a road under the patronage and with the help of Bolivia. This company was well organised, three of its directors being well-known gum brokers and the manager being thoroughly acquainted with the country and its resources.

The company was called the Beni Gum Company, and it was duly incorporated in New York.

An expedition was organised, all the machinery and the goods that could be of any use in the forest were purchased, packed and shipped to Mollendo. The manager and one of the gum brokers, as well as one of the directors, sailed for the Isthmus, and from Panama to Mollendo, and from there reached La Paz by Arequipa and Puno. Unfortunately, the manager was detained on the road, and only reached La Paz ten days after the others.

Now, some merchants in La Paz dreaded exceedingly the competition of the Yankee company—and with reason, for they could not bring on the market such a selection of goods as was coming. They united in trying to break up the Gum Company, taking advantage of the manager's absence to discourage the directors by telling them that they had been deceived; that there were no gum lands on which they could form an establishment; that the perils of the voyage to the Beni were such that only mad adventurers would attempt it; that the manager was one of these; and that, in fact, if they wanted an interest in gum, they could establish an agency in La Paz, offering their services.

When the manager arrived he learned that the directors in La Paz had telegraphed to the directors in New York their intention to break up the company, and, unfortunately, at the same time the chief broker became demented and had to be sent back to New York by the American Minister under a proper escort. The other director, having no desire to affront the "*perils*" of the trip to the Beni, remained in La Paz only the time necessary to deposit the goods in a German house, borrow money on such security, and return to New York. Shortly after the German house failed, and the company was ruined.

Had it fulfilled its programme it would now be worth millions, for this expedition had awakened the energies of the people, and a great number petitioned for concessions from the Government for gum lands, which could then be obtained for the payment of taxes, and which are now worth thousands and hundreds of thousands pounds sterling. Rapidly the province was invaded by prospecting men, and the Government adopted a rather singular way of measuring out its concessions. A *pertenencia* (or claim) was not measured by the area but by the number of trees; one hundred and fifty being the unit. This may in the future be troublesome for neighbors.

Up to this time only the borders of the different streams are in exploitation. It is yet difficult to penetrate in the wild forest, where there are no paths. It is time yet to obtain possession or control of extensive gum-bearing land, but this opportunity will soon be lost.

At present the traffic to the Beni and to La Paz is concentrated on the Pacific Ocean at the port of Mollendo—a miserable and unsafe open harbor, but the terminus of the Arequipa and Puno railroad. From Puno the goods and passengers navigate the Lake Titicaca and land in Chillillaya or Desaguadero.

In Desaguadero there is an indirect path going about 100 kilometres to La Paz by Huachi and Laya, and the Government has just contracted with French capitalists and engineers to lay down a railroad that will do away with the very badly-kept road from Chillillaya to La Paz.

When I left, six months ago, there were accumulated in the Custom-house of Chillillaya over fifty thousand quintals of goods to be transported to La Paz. All the available means of transport could not move more than three thousand to four thousand quintals per month, and the accumulated deposit was augmenting at the rate of two thousand or three thousand more per month. The railroad will be a success, and will rapidly pay for its cost.

The new port of Huachi, on the Desaguadero, will be in communication with the Corocoro district, and will have the transport of the copper ore.

The actual miserable cart-road from Chillillaya to La Paz will be abandoned, and will only be used to reach Sorata by Hachacache.

Sorata will remain the deposit of such goods and the traffic coming from the central northeast fields of the Mapiri river.

As soon as the railroad is opened from Desaguadero to La Paz there will be built a connection from Puno to Desaguadero, and the navigation of the lake will be considerably shortened.

We must now go back to the labor question, for it is the basis of the gum interest. We have said that it was impossible to obtain sufficient labor from the native Indians.

The Aymara Indians live on the high lands west of the Cordillera, and do not endure the tropical climate of the eastern low land. They will not contract for more than a few weeks at a time. An experiment was made to introduce Japanese labor, but it did not prove successful. That class of immigrants is very troublesome and unreliable. The negroes are the only people that will accept steady occupation. We had the experiment made in the black colony of Tipuani. The little village was entirely composed of black men of the third generation, originally runaway slaves from Brazil. They were the only men in the Mapiri valley on whom we could depend for clearing, cultivating or building. The Indian does not work—he fishes, hunts and navigates the streams, and lives by the fruits he raises and the gold he washes from the banks of the streams.

I believe that never was there such an opportunity offered to the black race to form a prosperous colony and be independently happy.

The advantages offered to the emigrants are the following:

First: A contract between the emigrant and the employer for four consecutive years, to date from the day of signature of said contract;

Second: All travelling expenses paid to the place of labor;

Third: Four acres of land given to each laborer to establish his house and garden;

Fourth: All material and facilities given free for the erection of house and clearing the site. If several in a family, all advantages to be multiplied by the number of working hands, women and boys above 15 years to be considered as able laborers (the work is light and easy);

Fifth: Wages in money for each worker, twenty dollars per month;

Sixth: At the expiration of the four-year contract the house and land belong definitely to the emigrant.

Full protection from the Government according to the emigration and colonial laws of the country. The emigrants can retain their rights as American citizens if they come from the United States, and as such can claim protection from the United States Minister residing in La Paz.

The work, I said, is an easy and light one. It consists in clearing the wild forest by cutting down the trees that are not gum and fruit bearers, such as coffee, cacao, quinine bark, orange, cotton, etc. The gum trees are tapped like maple sugar or acacia trees.

The men can also be employed in cutting and clearing roads and in washing gold; the girls being the best fitted to work the pan.

The workmen begin work at 5 A. M. and knock off at 12 or 1 P. M. They have all the rest of the time to themselves.

An able man or woman laborer can easily gather one hundred and fifty pounds of gum per month.

The cost of wages and expenses is fifty-eight Bolivian dollars per month. The market price of gum, paid at the place of production, is one hundred and eighty Bolivians per quintal. Therefore, one quintal and a half, produce of one workman's labor, will yield two hundred and seventy Bolivians, giving monthly a clear profit of two hundred and twelve Bolivians per laborer.

The Bolivian dollar is, more or less, worth fifty cents American money; therefore, the product will be one hundred and thirty-five dollars, the cost fifty-eight Bolivians (twenty-eight dollars), and the profit one hundred and seven American dollars. One thousand emigrants will pay monthly about one hundred thousand dollars ($100,000) American money.

The production of gum coming from the Beni to the Pacific is not yet well known; but it develops rapidly, and it is expected, as soon as the projected roads are in operation, to multiply in proportion to the demand. On the other gum-fields—Peruvian and Brazilian—in the year 1894, the production in February was as follows:

	KILOS.
On the Purus River	527,571
On the Jurua	280,249
On the Javari	200,278
On the Madeira	165,003
On the Rio Negro	50,937
On the Solimões	43,196
On the Jutahy	11,380
On the Amazonas	830
Total	1,279,444

or one thousand two hundred and seventy-nine and one-half tons.

Since then the demand and the price have greatly advanced.

Other countries are now awakening to the great resources available in the gum-gathering, and they are planting and cultivating wherever the soil is favorable. New Granada, on its low lands of the Darien, Venezuela, the Guianas, and Ecuador will compete in the market. But it takes twenty years to develop a rubber tree, and until then the forests of Peru, Bolivia and Brazil must supply the demand.

A year ago we received from the acting Governor of Surinam the following letter and document:

SURINAM.

PARAMARIBO, November 6th, 1899.

SIR:

I have the honour to ask your attention for the following concerning the trees producing India-rubber or caoutchouc, growing in the South American republics, Brazil, Peru, Bolivia, and Ecuador.

As you will perceive from a report by the Superintendent of the Botanical garden at Kew (Kew Bulletin of Miscellaneous Information, Nos. 149 and 150 of 1899), a copy of which I have the honour to enclose herein, these trees belong to the species of Hevea and Castilloa. The rubber from the Castilloa, called *Caucho*, of which caoutchouc is probably an expanded form, is collected by felling the tree, and that from Hevea called *Yebe*, *Yeve* or *Heve*, by tapping.

With regard to the fact that the demand for caoutchouc is increasing every year, it seems an important matter for a colony like Surinam to try to cultivate those caoutchouc-producing trees.

In order to make a trial with the cultivation of the said trees in our Botanical Garden at Paramaribo, I beg to ask your kind intermediation to forward to me if possible some seeds and young plants of Hevea and Castilloa.

In case you succeed in getting young plants the best packing to guard them against injury, as I am informed, is a tin-plate box filled with damp saw-dust.

I hope you will be so kind as to help me in this matter. The expenses which eventually are to be made in procuring and forwarding the seeds and plants will of course be refunded.

I have the honor to be Sir,
Your obedient servant,

Acting Governor of Surinam.

Afschrift.

(enclosure.) Royal Gardens, Kew,
May 23rd, 1899.

SIR:

I have the honour to acknowledge the receipt of your letter of May 12th transmitting a copy of Consul Churchill's report on a kind of India rubber exported from Peru, through Pará, under the name of Caucho.

2. Caucho, of which Caoutchouc is probably an expanded form, has been hitherto identified with India rubber *par excellence*, the produce of one or more species of Hevea indigenous to the basin of the Amazon, and exported from Pará. According to the information now received, the Caucho tree of Peru is a Castilloa. One or more species of this genus produces the India rubber of Central America. The South American Castilloa has been known to extend as far as Ecuador, where it is called "Yebe," otherwise Yeve or Heve. According to Aublet this latter name was given in Northern Ecuador to a species of Hevea, and in founding that genus he desired to name it accordingly. In the Amazon basin the name for the species of Hevea is "Seringa," and in Central America for those of Castilloa "Ule," or "Tunac" (see Kew Bulletin, 1898, 141, 142). Perhaps in Western South America the names Caucho and Yebe are applied indiscriminately to rubber-producing trees.

3. According to a report by Mr. M. B. Adamson, H.B.M. Consul at Iquitos, dated December 24, 1898, and published in the transactions of the Liverpool Geographical Society for the same year, Peru has two kinds of rubber-producing trees: Caucho, which appears to belong to Castilloa, and Yebe to Hevea (pp. 39, 40). Both Mr. Adamson and Mr. Churchill agree that the rubber is extracted from the caucho tree by felling. The Yebe is always tapped. The former process results in a district being worked out. In consequence, according to Mr. Adamson, many of the "Caucheros," or rubber collectors, are working on Brazilian rivers, where the supply is yet more plentiful.

4. It is not, however, necessary to fell the Castilloa trees to collect the rubber. The method of tapping is minutely described in a report in the United States Consular reports for May, 1899 (pp. 150 and 151).

The estimated yield per tree is much smaller than that given in Sir Henry Deling's report, as to which I addressed some inquiries to the Foreign Office in my letter of April 14th, 1897.

I am, Sir,
Your obedient servant,
W. F. THISELTON DYER.

There are no signs just now of any diminution in the demand for rubber, and, therefore, for years to come the gathering of gum will be a source of great fortune for those who will go to work at once.

Importation of black labor and opening of thoroughfares—removal of the obstacles in the rivers—establishment of laborers' villages and of working capital—will give enormous results.

Companies will be formed capitalized at the actual low value of the forest lands, and they will obtain dividends of one hundred per cent.

The country has been calumniated so far as its salubrity goes. It is not true that fever is prevalent. It attacks drunkards and men who lead disorderly lives; but those careful of their health can live there as well as elsewhere.

(*To be continued.*)

PHYSIOGRAPHIC NOTES.

BY

RALPH S. TARR.

Physical Geography of Texas.—Folio 3, of the Topographic Atlas of the United States, just published, is devoted to a description and discussion of the Physical Geography of the Texas Region by Robert T. Hill. It is a publication of decided importance to all students of the new physical geography, and ought in addition to be of great value in the schools of Texas and elsewhere. After a general description of the State there is a discussion of the relief, with special reference to the relation between the surface features and the geological formations; and Mr. Hill's treatment shows that this relation is decidedly interesting. While the treatment of the mountainous sections is excellent, it is natural that in this State, so typically a region of plains, the consideration of features connected with plains is most fully treated. There is, so far as I know, no other discussion of plains so elaborate as this. The State supplies types of a great variety of plains, and these are fully described, interpreted and classified. In connection with the description Mr. Hill has found it desirable to introduce several new terms, a number of which are borrowed from the Spanish.

Following the description of mountains and plains there is a briefer discussion of the rivers, in which many of the peculiar features of the Texas drainage are interpreted. This is followed by a general treatment of the climatic features, illustrated by maps, and the text closes with a brief statement of the economic geology and the main facts concerning the distribution of population.

The paper is more than a mere contribution to local physiography. Its breadth of treatment warrants us in ranking it as one of the notable contributions to general physiography ; and its value is greatly increased by the splendid illustrations printed upon sheets at the close of the Folio. These include a number of beautiful and well-selected half-tones of some of the more typical features which are capable of illustration by photograph ; and in addition to these are many map illustrations of features which are too large to be shown by half-tones. These maps are carefully selected from the topographic sheets of the United States Geological Survey. In no case is the entire sheet included, but merely those portions which illustrate the types. They therefore stand out as striking representations of the forms. The last illustration is a large folded contour map of the State, based to a considerable extent on Mr. Hill's own intimate knowledge of the surface features of Texas.

There is but one feature of the Folio which seems unfortunate, and that is its immense and unwieldy size. While this objection applies to all Folios of the Survey, it may be urged with greater force against this one, since it is not only unnecessary, but seriously interferes with its use in school work. The text is printed in four parallel columns on each page, making its study difficult in the extreme. Since the paper is so important a contribution, it is to be hoped that it will be found possible to publish it in book form. The larger map sections could be easily reproduced in a smaller size, making them full-page illustrations, and the map of Texas could be included as a folded map in a pocket.

THE CASCADE MOUNTAINS OF NORTHERN WASHINGTON.—The work which Professor I. C. Russell has been engaged upon during the last few years in the Cascades of northern Washington appears as a preliminary paper in the Twentieth Annual Report of the United States Geological Survey (Part II, pp. 83–210). In this paper Professor Russell makes some important contributions to the physiography of that region.

The prevailing westerly winds cause a warm, humid climate and heavy rainfall on the western side, where the snowfall is light near the sea-level, but heavy in the mountains. The fogs, clouds and rain of this western slope are in striking contrast to the sunny, arid, eastern slopes. In consequence, while the eastern Cascades are largely without trees, the western slope is clothed in a dense forest of giant trees. Professor Russell's description of this forest is the best that I have seen. He shows, too, that the difference of climate, so clearly defined at present, was also present during the Glacial Period. The existing glaciers of this part of the Cascades are, for the most part, on the rainy western side of the divide, and in the Glacial Period the glaciers on the western slope of the mountains were far more extensive and of greater thickness than those that descended the deeply-cut valleys on the east side. That this difference in climate is even more ancient than the Glacial Period is indicated by the fact that the west-flowing streams show evidence of greater maturity than the east-flowing streams. While this is due largely to differences in rainfall, it is, of course, to be explained in part by the fact that the west-flowing streams have shorter and more direct slopes to the sea.

This portion of the Cascade Mountains is a complex of wild and exceedingly rugged ranges, occupying a tract from one hundred to one hundred and twenty-five miles in width. The general elevation of these ridges is about 7,500 feet, giving the appearance of a plateau as viewed along the crests; but here and there peaks and groups of peaks rise to a still greater elevation. Among the peaks are some volcanic mountains, only one of which, however—Glacier Peak—is situated in the part of the Cascades which Russell has studied. The rocks of the mountains are metamorphic, igneous and sedimentary, varying, therefore, in power of resistance to the weather. They are, moreover, complexly folded, with the folds having north and south axes in the main, but with some folds and faults diverging at a high angle from the main trend of the Cascades. The age of the rocks varies from pre-Cretaceous to Tertiary, the older rocks being so metamorphosed that their exact geological age is unknown.

In consequence of the uniformity in elevation of the average crest of the ridges, taken in connection with the complexity of the texture and altitude, Russell concludes that

> The Cascade Mountains, as we now know them, seem to have been carved from an upraised peneplain.

His interpretation of the present form is that an older mountain system, long eroded, was ultimately reduced to the condition of a peneplain, then elevated bodily at least 7,500 feet, and later deeply dissected until the present rugged topography was evolved. To the present writer this interpretation of the topography seems to rest upon very unconvincing evidence. It is this sort of so-called peneplain against which I have protested in a recent paper. Without a more complete discussion of other explanations, there are a number of physiographers who will look with scepticism upon this hypothesis as applying to the interpretation of the rugged Cascades.

In the dissection of the Cascade Mountains there have been a number of interesting stream changes, which Russell discusses in his treatment of the river valleys. He points out that the greater part of the task of dissecting the land has been performed by running water, but that glaciers have done something to modify the contours of the valleys. These glaciers, now represented by mere remnants of a minute kind in the higher valleys, formerly flowed outward both to the east and west as true Alpine glaciers of immense size. Both the ancient and the existing glaciers are fully described in the text, and in connection with this description numerous instances are pointed out in which valleys have been modified by ice action through scouring, deepening and filling. A number of examples of rock basins are mentioned, and an excellent half-tone illustration of one of these is presented. There is a full description of the beautiful and interesting Lake Chelan, previously described by Gannett.

As previously stated, the ancient glaciers on the western side were the most extensively developed, and the ice upon that side was so thick

> that when the glacial conditions were at their maximum a general ice-sheet was formed, which buried some of the most prominent ridges.

These thick glaciers, descending to the plain at the western base of the mountains,

> expanded and united at their lower extremities and assisted in forming a large piedmont glacier which occupied the Puget Sound Basin. This piedmont glacier had two stages of broad expansion, separated by an interglacial stage, during which thick gravel deposits, together with layers of peat, were spread out on top of a basement layer of till.

It is noteworthy that it was Russell who described the first existing instance of a piedmont glacier, and that he, too, has given us this clear evidence of a much larger ancient example of a similar ice-sheet. Another feature connected with glacial deposit and post-glacial erosion is the deep filling of gravel and sand, in general, several hundred feet in depth, in the valleys of northern and eastern Washington. It is the excavation of these gravels in post-glacial times that has given rise to the beautiful terraces which border these streams. Russell presents clear evidence that the formation of these terraces has been due in no sense to a tilting of the land, but merely to increased power of erosion, due to the decreasing load of sediment resulting from the disappearance of the glaciers. The paper closes with a detailed discussion of the influence of avalanches and land-slides upon the topography of this region, followed by a very brief treatment of the economic deposits.

NOTES ON ETHNOLOGY.

BY

J. WALTER FEWKES.

NOTES UPON THE ETHNOGRAPHY OF SOUTHERN MEXICO. BY FREDERICK STARR, *Proc. Davenport Academy of Natural Sciences, Davenport, Iowa, 1900.*—Government statistics, according to Prof. Starr, show that about five-twelfths of the total population of Mexico are pure Indian, and while in general the inhabitants of the Northern States are mestizos, the aboriginal blood overwhelmingly predominates from the City of Mexico southward.

During the last three years Prof. Starr has made annual expeditions to our sister republic to ascertain and define the physical types of these tribes. In the course of this work he has made measurements upon 160 men and 25 women in each tribe considered, and obtained and made photographs and plaster casts from selected representatives of each tribe.

The results of the measurements he intends to publish later, but a selection from the photographs has been printed in a beautiful Ethnographic Album of one hundred and forty-one plates, with text.

This most valuable addition to our knowledge of physical anthropology he has now supplemented by a special article, containing ethnographic data in the form of notes, which will be widely welcomed among anthropologists as a timely contribution to an attractive subject.

These notes relate to sixteen or seventeen tribes visited by the author, the location of thirteen of which is shown on a sketch map accompanying the pamphlet.

The following tribes are considered: Otomis, Tarascans, Tlaxcalans, Aztecs, Mixtecs, Triquis, Zapotecs, Mixes, Tuaves, Chontals, Cuicatecs, Chinantecs, Chochos, Mazatecs, Tepehuas, and Totonacs. The article contains many valuable notes on the customs, languages, arts, religion and folk-lore of these tribes, survivals of ancient times. Many tribes have survivals of ancient pagan ceremonials, among which may be mentioned the so-called pastores and snake dances of the Tepehuas and Totonacs. The article contains suggestions regarding the limitations of linguistic stocks, and a vocabulary of seventy-nine words in nine languages arranged in a tabular form.

Plates containing good figures of articles of dress and other objects close the notes, which are valuable aids to the study of the ethnography of Mexico.

RECENT MEXICAN STUDY OF THE NATIVE LANGUAGES OF MEXICO. BY FREDERICK STARR. *The University of Chicago Press. Department of Anthropology. Bulletin IV.*—The catalogue of writers in the native languages of America by that eminent bibliographer, Icazbalceta, gives an idea of the wealth of literature in the aboriginal languages of Mexico. The output in this direction has not lessened since this valuable work was published, and Prof. Starr now calls attention to more recent literature in the same field. He disarms criticism by laying no claim to completeness, and does not include articles printed in Maya, of which there are many additional, nor those before learned societies printed independently. Prof. Starr has rendered an important service to science by calling attention to the activity of many native students of Mexican languages, whose names and works ought to be better known to our anthropologists.

DER URSPRUNG UND DIE WANDERUNGEN DER VÖLKER GEOGRAPHISCH BETRACHTET: II. GEOGRAPHISCHE PRÜFUNG DER THATSACHEN ÜBER DEN URSPRUNG DER VÖLKER EUROPAS, VON FR. RATZEL. *Königl. Sächs. Gesellschaft der Wissenschaften zu Leipzig.* Feb. 3. 1900.—The well-known Anthropogeographer, Prof. Fr. Ratzel, devotes an article to the origin and migrations of the European races in their relation to geographical conditions and changes—a most instructive subject, treated in an interesting way by a master.

Europe is a particularly good continent for the determination and verification of the laws of the influence of geographical conditions on the prehistoric and historic development of man. The human race has inhabited this land from a remote antiquity, reaching into a geological epoch antedating our own, and there is a large fund of archæological data to bring to the aid of a discussion of the problem. No less zeal has been shown, with unparalleled results, in the study of European geology and geography, and with all this wealth of material at his control the physical geographer is well equipped to consider properly the influence of environment on man, past and present. Prof. Ratzel has shown great skill in handling this material, and his work is a suggestive contribution to science.

The advent of prehistoric man in Europe antedates the Quaternary Epoch, which period is a natural beginning of the study of European man. Far-reaching in their influences have been the climatic changes since this land has been a habitation of the human race. Man lived in Europe when a great sheet of ice covered its whole northern part—when France, Spain and Italy were practically islands, or one large island, and Greece was connected by land across the Ægean Sea with Asia Minor. The habitable regions of Europe at that epoch were contiguous to Southwestern Asia, and the great glacier and inland waters formed by an enlargement of what are now the Caspian and Black Seas made all northern parts uninhabitable by the human race. Whatever influx of peoples there were from Asia at that time must have been along the only available route, or through Asia Minor, following the northern shores of the Mediterranean Sea. The climatic condition of Southern Europe at the Quaternary Epoch, the distribution of forests, tundras, steppes, and rivers, exerted a profound influence on this early man. Animals now extinct were hunted for food, and different forms of food plants no doubt existed.

The people of ancient Europe were not racially different from some of the races still found there, for the skull of the Stone Age man is anthropometrically the same as that found in certain parts of modern Europe. According to Ratzel there has always been the same race in Europe since the neolithic period. His consideration of the probable cultural condition of this early European is important; but even more instructive are his studies of the subsequent migrations of races and the distribution of races in post-glacial times. Various aspects of the influence of changes of climate and other geographical conditions on man are considered in a suggestive way. Ratzel concludes that the Sahara was once well watered, especially in its northern part, and was more densely populated. The former distribution of steppes in Europe has exerted a most important influence on the distribution of culture, for these treeless, grassy plains turn man to pastoral or nomadic life, and their distribution has exerted a profound influence on the migration of man in all lands.

In his introduction of the influence of the glacial epoch on the early distribution of man in Europe and the peopling of the northern parts, Ratzel deals with a most potent factor in European racial ethnography. This is not a new theme; and while glaciation may have obliterated traces of human habitation in the land over which the ice was spread, the fact remains that this epoch greatly modified climatic conditions in the South of Europe and Northern Africa. We cannot in discussing prehistoric man in Europe neglect preglacial man on the ground that the population of that time was too remote to be considered, as some writers advise; for the origin of

European man is intimately connected with climatic changes, and must be considered as a geographical question.

Carl Ritter, the founder of Physical Geography, in the infancy of Anthropology called Asia the land of the childhood, Greece of the youth, and Europe of the maturity of the human race. The great accumulation of archæological material since his day tends to modify this statement, especially regarding the relative antiquity of cultural areas of Europe. The highest development of stone-working man was in the North and Northwestern parts of Europe, in the Northern Alps, along the Danube, and in Southern Russia. An indigenous culture arose in France at the close of the Stone Age, and another, with Oriental affinities akin to the Etruscan, in the highlands of the Eastern Alps. This latter, or Hallstatt culture, was probably as high, if not higher—as old, if not more ancient—than that of Greece.

At the dawn of history there were numbered among the Mediterranean race the Iberians, Sikelians, and Ligurians of classical writers, inhabiting what are now called the Iberian and Italian peninsulas. Greece, Asia Minor and Syria were occupied by Proto-Armenians or Alarotic people, with Hamitic races at the extreme south of the last mentioned. The Ligurians lived along the coast of the Mediterranean—in Italy, France, Spain, and the neighboring islands; the Iberians inhabited the coast from the Pyrenees to the Rhone.

Among early European races the Etruscans deserve special mention, but their origin has led to much speculation. Ratzel seems to ally himself with that school which regards them as of Lydian origin, which conclusion readily harmonizes with available geographical data. The resemblances between the early Alpine and Hallstatt civilizations would be readily explained on this theory by former connection, and, later, separation by a Keltic people which had moved in between them. Sergi's theory that the Etruscan culture was composed of two ethnic elements—one Danubian, the other Mediterranean in origin—has much to recommend it.

The relation of the Mediterranean races to those of the Orient, as shown in the distribution of bronze and iron, is considered from both archæological and historical points of view. Evidences are adduced to show that these metals passed from Southwestern Asia to Southeastern Europe, and were disseminated northward and westward. Bronze entered Europe by two great pathways—one maritime by the Mediterranean, the other through trade or in the hands of colonists along the Danube.

Naturally the much-debated question of Aryan origin occupies a prominent place in Ratzel's discussion of European origins, and he considers it impossible to ascribe to the Aryans any characteristic culture. He finds, however, a parallelism in the distribution of the Aryans in Europe, and that of the two metals, bronze and iron, over the same continent. There is an important truth in Ratzel's statement that the question of race and that of culture are distinct, and the same holds also regarding language and culture. It is evident, as more and more facts are accumulated by anthropologists, that there never was a distinctively Aryan race swarming into Europe from Asia or Africa, as some would have us believe, but that the Aryan question is simply one of language. Have the resemblances in the linguistic roots of the so-called Aryans been derived from Asia or Africa, or have the similarities arisen independently? There is no distinct Aryan race, an Aryan culture is doubted by many, and the resemblances in languages, which have served as the basis of so much speculation, do not necessarily mean derivation, but may have resulted from the integration or composition of tribal languages, as pointed out by Major Powell.

It is impossible to do justice to Ratzel's main argument in a brief notice, and on that account the reader is advised to study in detail this important contribution to anthropogeography. It is accompanied by a map, following Deniker's interpretation, illustrating the geographical condition of Europe in the Quaternary Epoch, with lines indicating the supposed distribution of early races.

NOTES ON CLIMATOLOGY.

BY

ROBERT DeC. WARD.

The Geographical Distribution of Relative Humidity.—At the Bradford meeting of the British Association (1900) an important paper on *The Geographical Distribution of Relative Humidity* was presented by E. G. Ravenstein. In view of the fact that the observations of relative humidity as at present carried out at many meteorological stations and on board ship are not very reliable, the author has limited himself to indicating four grades of mean annual humidity, the upper limits of which are respectively 50 per cent. (very dry), 65 per cent., 80 per cent., and 100 per cent. (very damp). The relative humidity over the oceans may exceed 80 per cent., but in certain regions, such as the "horse latitudes," it is much less. Over a portion of the South Pacific it does not exceed 65 per cent. The salinity of the same portion of that ocean is greater than over neighboring regions. Another chart shows the Annual Range of Humidity, *i. e.*, the difference between the driest and dampest months of the year. In Great Britain, as in many other parts of the world where the tempering influence of the ocean is marked, the range does not exceed 16 per cent. In the interior of the continents, however, it occasionally exceeds 45 per cent., the spring and summer being exceedingly dry, while the winter is very damp. Thus, at Yarkand, the relative humidity in May is 30 per cent., while it is 84 per cent. in December. By combining temperature and humidity the author divides the earth's surface into sixteen so-called *hygro-thermal* types, which are as follows:

1. Hot (temperature 73° and over) and very damp (humidity 81 per cent. or more)—Batavia, Camaroons, Mombasa.

2. Hot and moderately damp (66–80 per cent.)—Havana, Calcutta.

3. Hot and dry (51–65 per cent.)—Bagdad, Lahore, Khartum.

4. Hot and very dry (50 per cent. or less)—Disa, Wadi Halfa, Kuka.

5. Warm (temperature 58°–72°) and very damp—Walfisch Bay, Arica.

6. Warm and moderately damp—Lisbon, Rome, Damascus, Tokyo, New Orleans.

7. Warm and dry—Cairo, Algiers, Kimberley.
8. Warm and very dry—Mexico, Teheran.
9. Cool (temperature 33°–57°) and very damp—Greenwich, Cochabamba.
10. Cool and moderately damp—Vienna, Melbourne, Toronto, Chicago.
11. Cool and dry—Tashkent, Simla, Cheyenne.
12. Cool and very dry—Yarkand, Denver.
13. Cold (temperature 32° or less) and very damp—Ben Nevis, Sagastyr, Godthaab.
14. Cold and moderately damp—Tomsk, Pike's Peak, Polaris House.
15. Cold and dry—
16. Cold and very dry—Pamir.

FAMINES IN INDIA.—The recent Indian famine, with its appalling loss of life, has naturally led to considerable discussion of questions concerning the causes of these famines, the relief of the poor during such crises, and the possible prevention of famines in the future. One of the most interesting publications which has appeared in this connection is a book entitled *Open Letters to Lord Curzon on Famines and Land Assessments in India*, by Romesh C. Dutt, Lecturer on Indian History at University College, London. While this volume is largely political in its nature, it contains a number of noteworthy facts concerning past famines, their causes, and the loss of life due to them. During a period of 130 years of British rule in India there have been twenty-two famines. The first great famine which attracted the attention of the British nation to this subject was the Bengal famine of 1770, which, like all famines there, was immediately caused by the failure of the monsoon rains, although the intensity of the famine and the great loss of life it caused were partly due to the maladministration of the East India Company, and the consequent impoverishment of the people. It is estimated that over ten millions of people died of this famine. Succeeding famines occurred in 1783, 1784, 1792, 1803, 1804, 1807, 1813, 1823, 1833, 1837, 1854. In 1833, 200,000 persons died in Gantur out of a population of 500,000. In 1837, after a failure of the rains, about 800,000 people died in Northern India of famine. The wars of the Indian Mutiny greatly interfered with cultivation, and a failure of the rains in 1860 was followed by a famine in which about 200,000 people died. The Orissa famine of 1866 resulted in the death of nearly 1,000,000 persons; while the famine of 1869, in Northern India, gave a mortality estimated at 1,200,000. The Madras famine of 1877 caused a loss of life estimated at 5,000,000. The intensity of this famine decreased markedly when the rains commenced. In 1897 a famine visited Northern India, Bengal, Burma, Madras, and Bombay which was more widespread and more intense than any that had occurred up to that time. No reliable figures, it is stated, are yet obtainable as to the loss of life during the present famine. Within the last forty years there have been ten famines in India, and at a moderate computation the loss of life from starvation and from disease brought on by them may be placed at 15,000,000. The immediate cause of famines in India is, in almost every instance, the failure of the rains. This cause must continue to operate, until, as Mr. Dutt says, there is in India a more extensive system of irrigation than has yet been provided. The author goes on to say:

> But the intensity and the frequency of recent famines are greatly due to the resourceless condition and the chronic poverty of the cultivators, caused by the over-assessment of the soil, on which they depend for their living . . . Land revenue is the most important item of the Indian revenues, and so it happens that the taxation falls heavily on the cultivators of the soil, and reduces them to a condition of chronic poverty. They can save nothing in years of good harvest, and consequently every year of drought is a year of famine.

Mr. Dutt points out that in the famines of 1877, 1897, and 1899 the parts of India which were over-assessed suffered most severely. The author's study leads him to the following conclusion:

> There is no doubt these famines are directly caused by the failure of the annual rains, over which man has no control; but it is equally certain that their intensity and their disastrous effects can be to a great extent mitigated by moderating the land tax, by the construction of irrigation works, and by the reduction of the public debt and the expenditure of India.

This condition of things in India furnishes an interesting illustration of the close relations that may exist between man, the climate in which he lives, and the laws by which he is governed.

CLIMATIC CONTROL IN THE DESERT.—A recent article on *Climatic Control in the Desert*, by Mary I. Platt (*Journal of School Geography*, Sept. and Oct., 1900), is very suggestive along the line of human climatology. Miss Platt classifies deserts as *arid* and *ice* deserts, and under each of these heads she considers some of the ways in which the climate of the desert has influenced man. The Sahara is taken as the type of the arid and Greenland as the type of the ice desert. The wonderful adaptation of plant and animal life to the hard conditions in which it finds itself in the arid or ice desert are clearly, though briefly, sketched. Schirmer's classification of the Saharan tribes into Nomads and Sedentaries is adopted. The Nomads camp near towns in winter, and wander with their flocks and herds in summer in search of water and pasturage, while the Sedentaries live throughout the year in towns near oases or near mountains on the edge of the desert. The food, occupations, and commerce in the Sahara are briefly discussed, and the characteristics of the people are shown to be closely affected by the conditions of life imposed upon them by the climate. Miss Platt draws some interesting parallels between the desert of sand and the desert of ice:

> Between the sand desert and the ice desert there are marked similarities and some contrasts. In the ice desert, all the people live on the edge. In the sand desert, nearly all the people live on the edge, near the border mountains or on the edge of the interior mountains. Nearly all the men of Sahara are nomadic, and the Eskimos are also, to a less degree. In Greenland the great enemy is the cold; in Sahara the great enemy is the sand. In Greenland the one great dependence of the natives is the seal, which supplies them with food, clothing, habitation and fuel; in Sahara the one chief source of maintenance is the date palm, which supplies food and wine, fibres for mats, wood for houses. Greenland is a white, desolate waste ; Sahara is a gray, desolate waste . . . In both places water is very scarce and has to be carefully treasured ; in both places wood also is very scarce and has to be most frugally used. In the one case there is monotonous cold ; in the other, monotonous heat. In Greenland the sun is welcomed back after the long night ; in Sahara the sun shines with a fierce, relentless glare, and the people hide from it by day, and travel largely by night . . . The people of the north are stolid, easily controlled, and low in physical and mental development. Conditions are too hard, and they have succumbed to them, only existing, not living. The people of the Sahara are alert, active, intelligent and enduring. They have a fighting chance, and so they fight to live, and in the contest are made strong.

GEOGRAPHICAL RECORD.

AMERICA.

THE NEW YORK HARBOUR IMPROVEMENT.—The work of deepening and widening the entrance to New York Harbour from the Narrows to deep water will be begun at once. The thirty-foot waterway now in use has a winding course through the channels known as Main Ship, Bayside, and Gedney. This passage is tedious, and the danger of collision is considerable. The East Channel is now to be deepened to forty feet and widened to 2,000 feet, and when the improvement is completed all vessels may hold their way in a nearly straight line from the sea to the Narrows, whence there is clear sailing to the wharves on both sides of the North River. The improvement will be completed in five years or less, and then the entrance to New York harbour will be unsurpassed by that of any other port.

Work is also about to begin on the deepening of the Bay Ridge and Red Hook channels from the inner end of East Channel, along the water-front of Brooklyn, to Buttermilk Channel. These channels are to be deepened to forty feet at low tide and widened to 1,200 feet, which will permit the development of dockage facilities along several miles of the Brooklyn water-front not now utilized. These improvements have been duly authorized by Congress. The proposed improvement of Buttermilk Channel is now before the House of Representatives. When all these improvements are carried out the East River fronts of Manhattan and Brooklyn Boroughs will have quick and safe communication with deep water and the commercial facilities of the port will be greatly increased.

ANTHRACITE IN THE UNITED STATES.—Practically all the anthracite of the United States is mined in an area covering only 480 square miles in northeastern Pennsylvania. It is mined mainly along the banks and in the valleys of three rivers: along and near the Susquehanna, with the largest centres of the industry at Scranton and Wilkesbarre; along and near the Lehigh, with the region around Mauch Chunk as the most prominent field; and along the Schuylkill, with Pottsville as the chief shipping point. It was a Pottsville furnace, in 1839, that won the prize of $5,000 offered by Philadelphians for the first successful smelting of iron ore with the use of anthracite. The fact that the Lehigh and Schuylkill lead to the Delaware and Philadelphia gave that city a great impetus in manufacturing in the days before railroads supplanted water carriage for anthracite. Even though a great strike, such as that which has recently terminated in the anthracite region, should be long continued, the resulting dearth of this fuel would have no appreciable effect upon iron production, because, though a little anthracite is still used for ore smelting, it has been almost wholly supplanted by bituminous coal.

EMIGRATION TO ARGENTINA.—According to the London *Times*, the Argentine Government has granted a large concession of land in its northeastern province, Formosa, in the Gran Chaco, and 20,000 Japanese farmers are to be settled in the eastern part of the province. This eastern portion of Formosa, near the Paraguay River, is the only part of it that is yet cultivated. It is rich in soil, forests, and waterways, and yields abundant crops of maize, tobacco, and sugar cane.

EUROPE.

SPAIN AND THE GREENWICH MERIDIAN.—A decree by the Spanish Government declares that after Jan. 1, 1901, time throughout Spain and the Balearic Islands, in all the public offices and courts, and in the railroad, telegraph, mail and steamship services shall be regulated by the time of the Greenwich Observatory. The railroad and the telegraph offices in Spain have heretofore used Madrid time, and the official time throughout Spain has been determined by the meridian of each locality. The substitution of Greenwich time will be a convenience not only to the Spanish nation but to all other countries in which the telegraph is used in business relations with Spain.

The official time in Portugal is that of the Royal Observatory, which is nearly thirty-seven minutes slower than Greenwich time. France and Portugal are now the only countries of western Europe that still maintain their own time standards.

IRRIGATION IN SPAIN.—The Government of Spain decided, in May last, to construct reservoirs and irrigation canals for enlarging the agricultural area. The country has therefore been divided into seven irrigation districts, and preparatory work has begun. The most of Spain receives less precipitation than any other part of Europe excepting the centre of the Kola peninsula, on the north coast of Russia, and the southeast coast of Russia around Astrakhan. The mountain system of Portugal and Spain, not far from the Atlantic border, prevents the moisture-laden west winds from carrying their burden of rain to the inland districts; thus, while there is enormous rainfall among the Cantabrian mountains in the north and ample precipitation in quite a large part of western Spain, the great central plateau and the western Mediterranean coast have an inadequate supply. Many of the rivers have cut very deep channels, and it is likely that the cost of raising the water from some of them would exceed the advantages to be gained. The Government estimates, however, that in the valley of the Ebro river alone 336,000 acres may be reclaimed. The irrigated lands in the valleys of the Ebro and Tagus are yielding twelve times as much fruit as the dry lands.

THE PALUTNOTCHNIE CANAL.—A telegram from Odessa, on Oct. 5, reported that the Russians had completed the Palutnotchnie Canal at the mouth of the Kilia, or northern branch of the Danube delta. More than sixty-three per cent. of the Danube waters have reached the Black Sea through the Kilia, but an extensive bar at the mouth of the stream has prevented that branch from being available for navigation except by small vessels. The St. George, or southern branch of the delta streams, has no commercial importance, and only the Sulina or middle branch, receiving but eight per cent. of the Danube, has afforded a passage for commerce to and from the Black Sea. By the improvement now made at the Kilia mouth, Russia has opened another important waterway for the Danube trade. Heretofore, Russian vessels on the Sulina have had to pass through Roumanian territory; but on the more northern route now opened they will skirt the southern border of the Russian province of Bessarabia for a long distance. It is expected that the new route will give considerable impetus to Russia's trade with the Balkan States.

MAPS SHOWING NATIONAL PROGRESS.—A number of German map houses have recently given much attention to the production of maps showing the empire's present development in respect of industries, colonial expansion, sea power, merchant marine, and so on. The aim is to present graphically the resources of the empire and its achievements and tendencies in the world of work. The fine map by Prof. Paul Langhans, published in *Petermanns Mitteilungen*, in May last, is a good example of these productions. The purpose of the map is to show the sea industries of the German coasts. Most of the information is conveyed by symbols. The number of regular steamship lines, vessels and docks, the amount of tonnage of each port, the total sea trade of each port for 1898, the shipbuilding centres and number of dry docks, the fishing ports, the towns where fish-curing is carried on, the chief fish markets, the routes by which fish are taken to Berlin, the distribution of the fisheries along the coasts, the distribution of coast population, and other information are shown with perfect legibility. The map gives an admirable bird's-eye view of all the industrial relations of the German coasts to the sea.

AFRICA.

MR. MOORE'S EXPEDITION TO LAKE TANGANYIKA.—Mr. J. E. S. Moore, whose party recently returned from Lake Tanganyika, read an account of his work before the Royal Geographical Society on November 26. The most important part of his paper related to the evidence he collected, that none of the great lakes of Central Africa, except Tanganyika, shows any sign of having formerly been connected with the sea. He found that Lake Nyassa has entirely the character of a typical fresh-water lake. It shows no trace of the prawns, the jelly-fishes, or the halolimnic mollusca (pertaining both to salt and fresh water) that are found in Tanganyika. While Nyassa lies in the southern extension of the same series of faulted valleys that also contain Tanganyika, the valleys of these lakes are not continuous. He found no vestige of any of the halolimnic animals in any of the lakes in the Rift valley north or south of Tanganyika, but this fauna did appear to extend into the Congo valley. It was only necessary for this extension to cover some eighty miles to bring it into communication with the great circular basin of the Congo itself. Much of this basin was formerly covered by the sea, and he was, therefore, strongly inclined to believe that the connection which the lake once had with the sea, and which resulted in the introduction of sea animals into Tanganyika, was on the west or Congo side of the lake.

THE DESICCATION OF LAKE NGAMI.—The desiccation of Lake Ngami, in South Africa, has made very rapid progress in the past ten or twelve years. When Livingstone reached the lake in 1849 he found it covering an area of about 300 square miles. The lake has now entirely disappeared. Its place is wholly occupied by a somewhat marshy plain covered with reeds, and no vestige of water surface is to be seen. The Taoge affluent has entirely dried up for about twenty miles from the lake, and above that point it is gradually disappearing. The inhabitants have abandoned their numerous villages around the lake, and only a few cattle-raising tribes remain.—(*Geographische Zeitschrift*, 1900, p. 343.)

ASIA.

THE DESICCATION OF THE PAMIR LAKES.—Lieut. O. Olufsen, of Denmark, has continued the researches which he began in the Pamirs in 1896. The first object of his latest expedition was to study the Yechil Kul, a lake in the eastern Pamirs, which is now much smaller than formerly. He hoped by means of precise hydrographic measurements to get an idea of the progressive diminution of this lake and of others in the neighborhood which, at one time, were a part of it. The desiccation of these lakes is one of the phases of the marked climatic changes in that region. The quantity of water formerly available for irrigation in Turkestan and Bukhara has diminished, and a number of oases once cultivated have been abandoned. This phenomenon has been caused by the diminution of the glaciers on the Pamirs which feed the Syr Daria and the Amu Daria, almost the only sources of life in those regions. The quantity of water derived from Pamir snows seems to have long been diminishing, not because less snow falls but on account of the erosion which is lowering the ridges and filling up the valleys. Thus the wind has greater sweep, and the snow is blown away as it is in vast expanses of Tibet. One of the affluents of the Amu Daria passes through the Yechil Kul, and the gradual drying up of that lake shows how the ancient Oxus is being deprived of an important source of water. The lake is now only thirty-seven miles in circumference, and its greatest depth is about 130 feet. There are five other lakes in the neighborhood, all of which are salt and surrounded by salt fields, though formerly they were fresh and were a part of the Yechil Kul, which at that time had a circumference of at least 125 miles.—(*Verhandlungen* of the Berlin Geographical Society, 1900, Nos. 2 and 3).

MISCELLANEOUS.

THE POPULATION OF HAWAII.—A census *Bulletin*, issued in November, shows the population of Hawaii on June 1, 1900, to have been 154,000—a growth of 41.2 per cent. over 1896, when the inhabitants numbered 109,020. Of the seven important islands, Oahu has the largest population, and about two-fifths of its 58,504 inhabitants live in Honolulu. Hawaii island has 46,843 inhabitants, the large expansion of the sugar industry having drawn many immigrants there since 1890. Maui, whose industries have been revolutionized by irrigation and its tillable lands practically all taken up, stands third with 25,416. Kauai, which has some very productive sugar and rice plantations and good grazing lands but almost no native population, comes next with 20,562. Molokai, on whose north shore the two leper settlements are situated, and little Lanai, south of it, have together 2,504 inhabitants, and are the only islands that have decreased in population since 1896. Niihau, the most western island of the group, is practically owned by one white man, and its population is only 172. The percentage of increase in the entire group in the past ten years is 71.1. In other words, the population has increased over seven-tenths in the past decade. The great development of cane sugar-growing has been the largest material factor in promoting this rapid increase in population. The islands are the third largest producer of this commodity in the world. About 300,000 tons of raw sugar are produced every year, and nearly all the money invested in agriculture goes into sugar-planting.

FALCON ISLAND REAPPEARS.—*La Géographie* (Oct., 1900) says a letter has been received from Mr. Vossion, the Consul General of France in the Tonga group, announcing that Commandant Ravenhill of the cruiser *Porpoise* reports the re-emergence of Falcon island, which is now about ten feet above sea-level. In April, 1899, it was reported that after a brief life of fourteen years Falcon island had ceased to exist. The island was formed by a great volcanic eruption at the bottom of the Pacific in 1885. It appeared above the surface about thirty-five miles from the island of Tofoa, in the Tonga group. A submarine volcano had reared, from the bottom of the ocean, a great mass of ejecta, and the outpourings rose above the water. The island consisted of two distinct parts. One of them was a hill of gentle slope and wide base, whose height was 153 feet. The other part was a flat extending away from the base of the hill and only ten to twelve feet above the high-tide level. The island was merely a bare, brown heap of ashes, destitute of vegetation save for a half-dozen seedling plants. Great rollers from the sea swept up the black shores, and Mr. J. J. Lister, who visited the island a few years before it disappeared, reported that it was rapidly being torn to pieces by the waves. It finally disappeared last year, and its reappearance now is doubtless due to another volcanic eruption.

THE GULF STREAM MYTH.—The September number of the *Monthly Weather Review* has an interesting article with the above title, which says that

> by itself alone the Gulf Stream has as much effect on the climate of northwestern Europe as the fly in the fable had in carrying the stage coach up the hill.

It adds that the mild climate of northwestern Europe is due, not to the Gulf Stream, but to the prevailing eastward and northeastward drift of the air currents, which distribute the heat conserved by the whole of the Atlantic Ocean north of lat. 35°.

The article is a refutation of the old story that the Gulf Stream, with its genial warmth, makes Norway habitable, keeps the harbour of Hammerfest north of the Arctic Circle free from ice, and gives an agreeable climate to the whole of northwestern Europe.

It may be added that about ten years ago the *Proceedings* of the Royal Geographical Society said it would

> probably take a generation or two to eradicate the old erroneous notions of text-books and popular treatises concerning the Gulf Stream.

From the time of the *Challenger* soundings to the present all evidence collected by such experienced hydrographers as Carpenter, Buchanan, Findlay, Thoulet, Agassiz, and others, shows that the Gulf Stream, as such, ceases to exist somewhere east of Newfoundland.

POLAR REGIONS.

Letters from Peary.—Mr. Herbert L. Bridgman, secretary of the Peary Arctic Club, printed in the Brooklyn *Standard Union* of November 26 the following extracts of letters from the explorer, communicated by the family of Mrs. Peary in Washington.

These letters from Peary were carried by natives to the camp of the Stein party at Cape Sabine, Ellesmere Land, and were taken to Cape York by Dr. Kann, who left Greenland on the 9th of June, in the steamer *Eclipse*, and landed at Dundee, Scotland, November 9.

Fort Conger, Lady Franklin Bay,
March 31, 1900.

Just a line to go down to a whaler by returning natives. I arrived here at midnight of the 28th, twenty-four days from Etah. Six and one-half days of this time we were held in camp by heavy windstorms. The doctor and Henson each left Etah with natives before we arrived here. The journey was a tedious one, owing to the storms, but not an uncomfortable one for me. A number of the dogs died on the way, but I had an ample number for the work ahead. Twenty-one musk oxen were killed in sight of the fort the day before I arrived, so we have an abundant supply of fresh meat.

After resting and feeding the dogs a few days longer I shall go on with Mott and the best Eskimos up the northwest Greenland coast. The Doctor and the other Eskimos will remain at the fort, hunting. I am in good condition, and the journey shows me that I am myself again. If I do my work this spring I shall come back and hasten down to meet the ship, and turn back with her. I hope to write again by natives whom I shall send back from some point up the Greenland coast. Dr. Dedrick wishes to be remembered.

Cape D'Urville, Grinnell Land.

I write this note on the chance of Stein and Dr. Kann reaching Upernavik by way of Melville Bay. The fall and winter passed comfortably at Etah, without even a day's indisposition on my part. I have husbanded myself carefully. My feet have given me very little trouble, and now I feel that I am myself again. I am now at the *Windward's* winter quarters, with the rear division. Mott and the doctor are ahead, with two other divisions, all on the way to Conger. All but a few of the natives will return at once from there, leaving a few with me. I shall push on from Conger without delay, perhaps by way of the Greenland coast. I shall strain every nerve, and, God willing, shall do my work this spring, that I may come back this summer. I send duplicate of this to Cape York for a whaler.

(Dated March 12, 1900.)

This is the first direct information received from Peary since August 28, 1898, and it is most encouraging evidence of his unabated resolution, activity, and energy. He and his companions were in perfect health, and they had abundant supplies for the task before them. There is every reason to believe that this task will have been accomplished in the early summer of 1901, and that Peary will join his wife and child at Etah, to return with them in the *Windward.*

The Stein Expedition to Ellesmere Land. — Dr. Robert Stein, with two companions (Dr. Leopold Kann and Samuel Warmbath), landed at Cape Sabine, Ellesmere Land, August 5, 1899, to carry out a plan for the exploration of that region, formed by Dr. Stein. Dr. Kann, in June of this year, took passage on the Scotch whaler *Eclipse*, at Cape York, and landed at Dundee, November 9. He brings a report of the experiences of the party in Ellesmere Land.

Their first care, after setting up their tent, was to build a house for the winter—a labour of three tedious months, during which they suffered with the cold. The house was named Fort Magnesia. It stood in a corner sheltered from the north and northwest winds, and contained two rooms—a store chamber and a living room. In the latter the cooking was done. The party enjoyed excellent health all winter. Before reaching Cape Sabine, Dr. Stein secured a sledge and ten Eskimo dogs, which were kept alive for months, though it was difficult to obtain sufficient food for them.

The period of total darkness lasted 123 days at Fort Magnesia. During this time it was impracticable to explore at any distance from the base of operations; but a number of astronomical observations were made, and bears, foxes, hares, and other game were caught. Mr. Warmbath was an active hunter, and he secured many specimens of the fauna, though there were practically no birds, other than a few gulls.

Late in the winter Fort Magnesia received three visits from members of the Peary party, Peary himself coming on March 6. It became clear to Dr. Stein that Peary would not be returning to the United States in the summer of 1900, and that there was no certainty of conveyance homeward for his own party. He had provisions to last a year, but not more, and it became necessary to utilize the next few weeks and the remaining stores in getting a little nearer to civilization, instead of pursuing the exploration for which the camp at Fort Magnesia was founded.

Dr. Stein had already made sledge journeys to the westward, and found evidences that Sverdrup had tried to locate the western and northwestern boundaries of Ellesmere Land. Dr. Stein has learned that large herds of musk oxen exist in Ellesmere Land, and remains of Eskimo houses, over a hundred years old, have been found. Dr. Kann declares that he and Dr. Stein made a number of valuable discoveries, but he gives no details.

Dr. Kann was under obligation to return to Austria in the autumn. In the middle of March he started with an Eskimo guide for the Greenland coast, and was followed in April by Dr. Stein. In June they reached Cape York, and there met the *Eclipse*. Dr. Kann went on board the whaler, but Dr. Stein made his way back to Fort Magnesia, with the purpose of continuing the exploration of Ellesmere Land.

Dr. Kann reports that Capt. Sverdrup's party wintered on Cocked Hat Island, northwest of Cape Sabine.

THE BROOKLYN STANDARD UNION, of December 8, announces that the personal effects of the members of the Lady Franklin Bay Expedition, recovered at Fort Conger by Mr. Peary in May, 1899, have been distributed by the Peary Arctic Club to Gen. Greely, Hospital Steward Biederbick, and Sergeant Francis Long, survivors of the expedition, and to the representatives of the many deceased members.

The Beaumont sextant, recovered at the same time, and returned to the Lords of the Admiralty in April last, has been deposited in the Museum of the Royal Naval College at Greenwich.

THE MARCH TO THE NORTH BY CAPT. CAGNI.—The *Bollettino* of the Italian Geographical Society publishes (Serie IV, Vol. 1, No. 10) the account of the sledge journey, in March and April, when the highest north was reached by the expedition under the Duke of the Abruzzi.

The definitive start was made on the 11th of March, in very bad weather, with the thermometer at −50° Cent. (58° below zero, Fahr.) and the ice hard and rough in places, and sometimes covered with heavy snow.

On the 21st, Capt. Cagni sent back Lieut. Querini, the guide Felice Ollier, and the machinist Alfred Stoekken. Nothing has since been heard of these three men.

On the 31st of March a second party, composed of Dr. Cavalli, the guide Savoye, and midshipman Cardenti, was sent back to the camp, and reached it in twenty days.

Capt. Cagni continued his journey with the two Alpine guides, Petigax and Fenouillet, and Canepa, a seaman. They had six sledges and sixty dogs, and food for two months; but the supplies began to give out, and the dogs died or had to be killed. At 85° N. the ice became easier, and at last they reached Nansen's furthest north—86 degrees 14 minutes. After a careful observation to make sure of this they passed beyond, and on April 26, 1900, they touched 86 degrees 33 minutes N., at about 56 degrees E. Long., when it was decided to turn back. They reached the camp on the 23d of June with two sledges and seven dogs.

A TELEGRAM FROM CHRISTIANIA, of November 27, announces that the Duke of the Abruzzi has completed his arrangements for the relief expedition next spring to Franz Josef Land in search of the Norwegian machinist Stoekken, and the two Italians, who were lost during the recent expedition.

The search party will be commanded by Captain Stoekken, father of the machinist, who has conferred with the Duke of the Abruzzi and Dr. Nansen.

BARON TOLL'S expedition, it is reported, is wintering in the Kara Sea, and will send a party in the spring to the Taimyr Peninsula, where it will establish a station for scientific observations.

THE GERMAN AND BRITISH expeditions to the Antarctic will co-operate in every way. The start is to be made in August, 1901, and the plan divides the Antarctic regions into four quadrants:

The Victoria, which includes Victoria Land, and extends from 90° to 180° East;

The Ross quadrant, from 180° to 90° West;

The Weddell quadrant, from 90° West to 0° (Greenwich meridian), the Weddell Sea;

The Enderby quadrant, from 0° to 90° East. This includes Enderby Land.

The British expedition will devote itself to the Victoria and the Ross quadrants, and the German will explore the Weddell and the Enderby.

The German plan contemplates a stay of three years, and the British, it is hoped, will be able to raise the funds needed to perform equal service.

Dr. Nordenskiöld has bought for his South Polar expedition the *Antarctic*, the vessel used by Lieut. Amdrup in his successful East Greenland voyage.

THE NORTHWESTERN BOUNDARY BETWEEN THE UNITED STATES AND CANADA.

BY

RICHARD U. GOODE.

During the progress of the survey by the U. S. Geological Survey of a portion of the boundary line between Idaho and Montana it became necessary to identify a point on the boundary between the United States and Canada, so as to locate properly the terminal point of the line under survey. The nearest international boundary monument that existed was the Mooyie Trail monument, which was about 8½ miles west of the point of intersection. Previously, in the survey of the boundary line between Idaho and Washington, no direct connection with any monument marking the international boundary was attempted, as the nearest points marked were one near the Columbia River, about 13 miles west, and one near the Kootenai River, about 20 miles east. Similarly, in extending a guide meridian north from the 13th Standard Parallel in Idaho, there was no international boundary monument sufficiently near to permit of a connection being made. Thus, in the above-mentioned localities and many others, it is impossible to locate the line which separates the domain of the United States from that of Canada. In view of these conditions, and, further, that recently there has arisen a controversy in regard to the location of valuable mines in the Mount Baker mining district in western Washington—certain parties claiming that the mines are in the United States and others maintaining that they are in Canada—it seems appropriate to present a brief summary of the facts relating to the survey of our northwestern boundary.

The northern boundary, generally, has been the subject of much discussion and dissension between the representatives of the two countries interested. There have been recognized in the various treaties three distinct portions of this boundary, and many commissions have been organized from time to time for the survey and marking of the line.

The northeastern boundary, extending from the eastern coast of Maine to the Lake of the Woods, was agreed upon by the treaty of peace concluded at Ghent, December 24, 1814, and was eventually surveyed and marked in a satisfactory manner.

The portion of the boundary between the northwest point of the Lake of the Woods and the summit of the Rocky Mountains, along the 49th Parallel, was the subject of the second article of the convention between the United States and Great Britain held October 20, 1818. This was surveyed by the Northern Boundary Commission in 1872 to 1876 and marked in a substantial manner, 388 monuments having been established in a distance of about 861 miles (7½ miles from the northwest point of the Lake of the Woods south to the 49th Parallel and 853⅓ miles west along the 49th Parallel to the summit of the Rocky Mountains).

The portion of the boundary west of the summit of the Rocky Mountains is usually referred to as the Northwestern Boundary. It includes a land portion extending along the 49th Parallel to the sea coast at Point Roberts and a water portion extending through the waters of Georgia, Haro and Juan de Fuca Straits to the Pacific Ocean. The definition of the water part of the boundary line was agreed upon in a treaty proclaimed August 5, 1846, but it was not until ten years afterwards that Congress made provision for a commission on the part of the United States to unite with a similar commission on the part of Great Britain to survey the northwestern boundary and establish the necessary monuments. The joint commissioners having disagreed as to the water boundary, it was finally settled in 1871 by arbitration. Emperor William I. of Germany was chosen as arbiter, and he decided in favor of the American contention. In the meantime, operations were commenced on the land portion of the line; but it is evident that thorough work was not contemplated, from an agreement entered into between the commissioners in regard to the conduct of the field operations. This agreement was as follows:

> After discussing plans for determining and marking the line as far eastward as the Cascade Mountains, it was concluded to be inexpedient at the present time, in consequence of the great expense, consumption of time, and the impracticable nature of the country, to mark the whole boundary by cutting a track through the dense forest.
>
> It was therefore agreed to ascertain points on the line by the determination of astronomical points at convenient intervals on or near the boundary and to mark such astronomical stations, or points fixed on the parallel forming the boundary, by cutting a track of not less than 20 feet in width on each side for the distance of half a mile or more, according to circumstances. Further, that the boundary be determined and similarly marked where it crosses streams of any size, permanent trails, or any striking natural feature of the country.
>
> In the vicinity of settlements on or near the line it is deemed advisable to cut the track for a greater distance and to mark it in a manner to be determined hereafter.

Under the above agreement, which was subseqently applied to the whole line, work was prosecuted through the field seasons of 1858, 1859, and 1860, the results being that, of the entire boundary, 410 miles long, 190 miles were cleared and marked and 220 miles were not surveyed or marked in any way. The principal unsurveyed and unmarked portions are indicated below:

From summit of Rocky Mountains westward to Kishenehn Creek	13	miles.
Flathead River to Wigwam River	13	"
Wigwam River to point 6 miles east of Kootenai River	14	"
Point 4 miles west of Kootenai River to Yaak River	17	"
Yaak River to Mooyie River	24	"
Mooyie Trail to Kootenai River	14	"
Kootenai River to Kootenai Mountains	25	"
Kootenai Mountains to Clark Fork	9	"
Clark Fork to Columbia River	11	"
Similkameen River to Naisnuloh Station	12	"
Naisnuloh Station to Paseyten River	24	"
Paseyten River to Chuchuwanten Creek	6	"
Chuchuwanten Creek to Skagit River	17	"
Stream 6 miles west of Senehsay or Selacee River to De Lacy Trail from Whatcom to Fort Hope	16	"

From Columbia River to Similkameen River, a distance of about 96 miles, the line was marked by sixty-seven monuments, although even in this distance there are thirteen unmarked intervals greater than 2 miles, including three greater than 3 miles.

From Skagit River to stream 6 miles west of Senehsay or Selacee River, a distance of about 30 miles, there are intervals of about 1½, 3, 5, 4 and 6 miles in which there are no monuments.

From the De Lacy Trail to Point Roberts, a distance of about 46 miles, the line was well marked by forty-two iron pillars and one obelisk at Point Roberts. All other monuments established on the line were piles of stone or earth.

The Civil War followed soon after the completion of the field work of the Northwestern Boundary Survey, and probably on this account no report of the operations of the survey was published, although there is evidence that such a report was prepared.

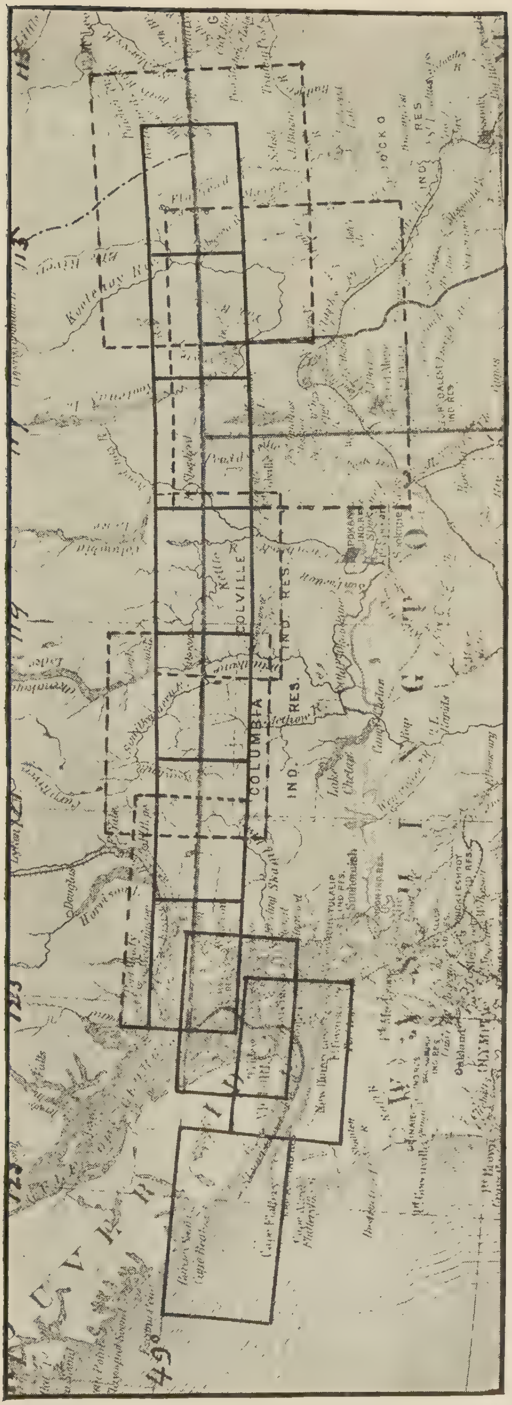
No trace can be found of the manuscript of this report, however, although careful search has been made through the Departments at Washington and the files of Congress.

Various manuscript maps relating to the Northwestern Boundary are on file at the State Department. The most important are ten detailed sheets, seven relating to the land portion of the boundary and three to the water portion. On the former are shown trails, timber, camps, monuments and vistas cut through the forest. These sheets are carefully drawn on the scale of 1:120,000, or about 1.89 miles to one inch, the relief being represented by hachures. A conventional sign indicating the timbered areas is also introduced.

In addition to the detailed map, there are other maps and tracings, one set having some geographic value, being a compilation from original sketches, notes, and surveys. These maps include the areas covered by the detailed maps and considerable territory besides, evidently having been compiled from observations secured by various members of the Northwest Boundary Survey while making journeys and reconnaissances in connection with the immediate work in hand. The relief is shown by sketch contours, and the accuracy obtained, as indicated by comparison with recent topographic surveys, is remarkable, considering the circumstances under which the maps were made. The scale is identical with that of the detailed maps, and it is probable that the contours were originally drawn for the purpose of serving as a guide for the development of the hachure work on the detailed maps. None of these maps have been published, except that a few lithographic copies of the detailed maps, enlarged to twice the scale of the originals, were prepared and had a limited distribution in a few of the Departments at Washington. The existence of these maps is not generally known, and it is probable that if copies had been available for the use of those interested in the mining properties in the Mount Baker district an inspection would have given sufficient evidence to settle satisfactorily the question whether the mines are in the United States or in Canada.

There is presented herewith an index map showing limits of the detailed and reconnaissance sheets.

There was also deposited by the British Minister in 1871 in the State Department an atlas comprising maps, views, and tables of geographic positions relating to the Northwestern Boundary. The information contained in this atlas is practically the same as that shown on the original maps prepared by the United States officials, except that the British atlas contains ten photographic views of monuments and vistas. With the atlas are tables of geographic co-ordinates, with descriptions of stations. According to these tables there are 161 monuments, marking parts of a boundary line 410 miles in length.



INDEX MAP, SHOWING LIMITS OF UNPUBLISHED DETAILED SHEETS (CONTINUOUS LINES) AND RECONNAISSANCE SHEETS (BROKEN LINES) PREPARED BY THE U. S. NORTHWESTERN BOUNDARY SURVEY, ON FILE IN THE STATE DEPARTMENT, WASHINGTON.

There can be no doubt that the line should be carefully traced and substantially marked throughout its entire length by a joint commission. Estimates for doing this work have been submitted to the State Department, and these estimates include the astronomical determination of the latitude and longitude of a number of additional points, the extension of a system of triangulation along the axis of the line, the running of spirit-levels over the line, the preparation of a topographic map of the territory adjacent to the line, as well as the cutting out and marking of the line by stone and iron monuments, the monuments to be placed at intervals averaging not more than a mile.

A large portion of the country to be traversed is without roads or trails. In fact, the conditions and difficulties at present are not much different from those which existed when the original commission decided that it was not practicable, on account of the difficulties, to establish the line completely.

The summit of the Cascades adjacent to the international boundary is above the timber-line, and immense glaciers lie athwart the line. A short summer comes between the storms of a late spring and those of an early autumn, while the snows of one winter are scarcely melted before they are replaced by those of the next. Turgid and impassable streams, born of the glaciers, flow between precipitous ridges and lofty granite peaks, making long detours necessary to an advance in any direction. On either side of the summit, below the timber-line, is a thick mantle of vegetation, with great firs and cedars growing up from a mass of tangled underbrush. The above are, briefly, the characteristics of the country along and adjacent to the line in the Cascades, and the same difficult conditions exist in a somewhat less degree along the remaining unsurveyed portion of the line. On account of the shortness of the practicable field season, it is believed that at least three or four years would be required to execute the surveys necessary to the proper marking of the line.

THE SCIENCE OF THE TIDES.

A STUDY IN PHYSICAL GEOGRAPHY.

BY

ALEXANDER BROWNLIE.

The adherents of tidal science cannot avert the charge that the science has a defective title. The most convincing arguments advanced against its credibility have come from themselves. The science is wholly artificial, because it was created at a time when men were absolutely ignorant of the tides of the world.

In support of our thesis we cite as witness one of the masters, Prof. George Howard Darwin. His book, "The Tides," is the latest standard text-book of the science, from which we quote:

1. "The equilibrium theory is terribly at fault . . . utterly contradictory to fact." (Page 160.)
2. "It is nearly as much wrong as possible . . . It would seem as if the moon actually repelled water." (Page 161.)
3. "Both the dynamical and equilibrium theories must be abandoned as satisfactory explanations of the true conditions." (Page 180.)
4. "The form of equilibrium can never be attained by the ocean." (Page 151.)
5. "The tidal problem is insoluble." (Page 188.)

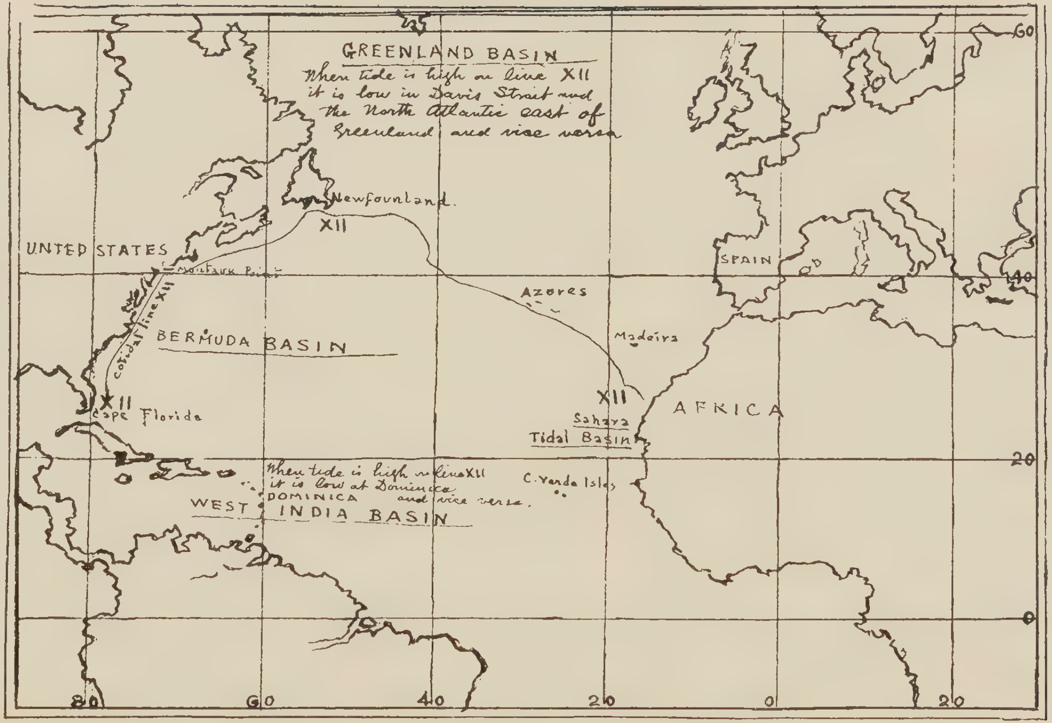
The same master further acknowledges that the direct attraction of the moon has never been measured; it has never been demonstrated that the moon can lift water, although the proof has been sought for diligently. By this expert evidence we know that the science rests on faith only; but that is not scientific.

Nevertheless, Mr. Darwin sets it up again on a new basis—"The Correct Prediction of Tides":

6. "Good tidal prediction is one of the greatest triumphs of the theory of universal gravitation." (Page 250.)
7. "The utmost that can be expected of a tide-table is that it shall be correct in calm weather and with a steady barometer. But such conditions are practically non-existent." (Page 242.)

The admission in the seventh quotation renders void the claim in the sixth. Therefore the new basis is a failure also. Ere leaving this part of the subject, however, we make the point that the tide-tables for the year 1900 by the United States Coast and Geodetic Survey predicted the ordinary diminutive tides at Galveston on the day the waters of the Gulf inundated that city.

From that practical lesson we ask: If wind travelling 100 miles



SKETCH MAP of COTIDAL LINE XII
from Cape Florida to central southern Newfoundland & Atlantic Tidal Basins.
NOTE. The extension across the Atlantic is imaginary, but appears on all theory maps

an hour drove the waters to overwhelm Galveston, what could escape annihilation were theory waves, travelling 1,000 miles an hour, true?

In setting up physical geography as the basis for correct tidal-study we set it upon a sure foundation, because founded on observed facts, and we begin our study by observing carefully the longest and best-established co-tidal line in the Atlantic Ocean—co-tidal line XII. (meaning 12 o'clock; co-tidal means tide at same absolute time). That line forms the boundary of the United States from Cape Florida to Montauk Point; it then disappears from the eastern coast, but is observed again in central southern Newfoundland.

The tidal disclosures made by it are absolutely destructive to theory. For example, tide is instantaneous on it over 21° of latitude. Tide is also instantaneous on it over 24° of longitude; but the longitudinal difference is greatly aggravated by a theoretical extension across the Atlantic, because that extended line (across the Atlantic) means instantaneous tide over 60° of longitude. Whereas the moon, the supposed strongest tide-lifter, takes four hours to travel the distance!

Again, theorists admit that tide is twelve hours late daily in travelling to line XII.; that admission creates an extraordinary tidal tangle, because the moon is regular in its movements to the thousandth part of a second.

Moreover, the Atlantic has two flood-tides and two ebbs daily, operated on strict schedule time; and in accordance with that fact theorists admit that two floods start daily from the south. Suppose we grant it, it follows that two ebbs must start daily from the north—and we know by observation that ebbs travel as fast as floods—consequently there are four theoretical tides travelling in opposite directions 200 to 600 miles an hour!

In view of all this, our study of line XII. teaches us—

1. That tide is not due to a travelling wave, because it is instantaneous over 21° of latitude; whereas, theoretically, it takes over two hours to travel that distance.

2. That tide is not due to lunar attraction, because the moon cannot drive waves across its own path; that is not consistent with the original theory or the modern development.

3. That tide moves slowly and deliberately from a centre to the circumference; therefore Nature itself drops the word "speed"—in the sense of a globe-travelling wave—out of the problem.

4. That tide, studied by the new method—geographical observation—is absolutely destructive of the old theory.

The new method of observing, fortunately, has a precedent. One of the main objects of the Challenger Expedition in 1872 was to solve the problem of ocean currents. After a thorough observation of them it was finally demonstrated that the circulation of ocean currents was due to opposition of temperature. The moon has no hand in all that work. And we hereby challenge the claim of mathematicians that IT is the cause of the other circulation of the ocean—the tides.

Our method of study is not all destructive. On the contrary, it is strongly constructive; and in setting forth a new theory we claim, as a fundamental principle, that tide is due to opposition of level in contiguous masses of water, one mass standing at high level, immediately contiguous to another at low level.

Observation has demonstrated that such conditions exist in the Atlantic, and we single out three of these regions to illustrate the problem:

1. We select the region of line XII., or rather its basin, which we call The Bermuda Tidal Basin.
2. We name the region north of it The Greenland Tidal Basin.
3. We call the region south of it The West India Tidal Basin.

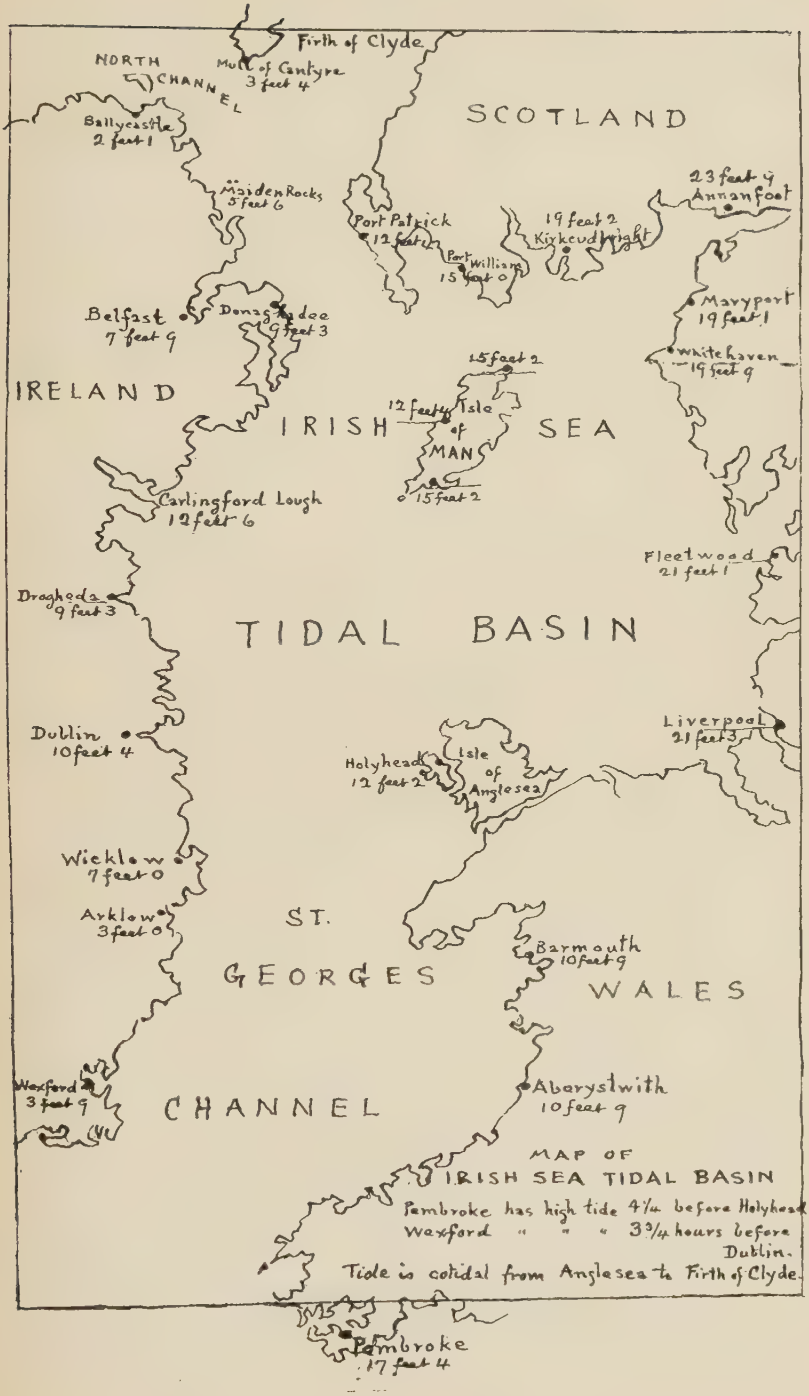
By observation we know that when tide is high in the Bermuda Basin it is low in the Greenland and West India Basins.

When tide is high in the Bermuda Basin it generates a motive power within its own mass, because of its high level—the power of gravitational pressure. We are persuaded that its higher waters must gravitate toward the contiguous lower waters. Hence, if that is correct, then gravitation is the key that unlocks the tidal mystery.

In like manner, when tide is high in the Greenland and West India Basins it is low in the Bermuda, and simultaneously their higher waters gravitate toward Bermuda's low level. Each time a basin is pressed to highest level a renewal of motive power is inevitable, and that motive power is not exhausted until it has pressed the low level up to the high level.

These three Atlantic basins possess an inherent motive power within their own masses every time a mass attains highest level—as self-acting of its kind as the actions of earth and moon.

The new tidal principle just disclosed is that of Double Pressure, and the same principle occurs in the Irish Sea; that sea receives a twofold supply through the two entrances, resulting in a simultaneous vertical lift extending from Anglesea to the Firth of Clyde; these two geographical units form one small co-tidal basin, and in that basin the water rises because of the double pressure.



MAP OF
IRISH SEA TIDAL BASIN

Pembroke has high tide 4¼ before Holyhead
Wexford " " " 3¾ hours before Dublin.
Tide is cotidal from Anglesea to Firth of Clyde.

The sea southwards from Anglesea is not co-tidal; on the contrary, the difference in time increases greatly.

Besides the principle of double pressure, that co-tidal basin discloses a large differentiation in the height to which tides rise. For example:

BRITISH SIDE.	MEAN RISE.	IRISH SIDE.	MEAN RISE.
Annanfoot	23 feet 9	Belfast	7 feet 9
Maryport	19 " 1	Carlingford Lough	12 " 6
Liverpool	21 " 3	Dublin Bay	10 " 4*
Holyhead	12 " 2	Wicklow	7 " 0

By the table we see that Britain is in receipt of an enormous supply compared with Ireland; at high tide there is an inclined plane sloping downwards from Britain; at low tide the inclined plane slopes downwards from Ireland. For example:

Mean low water............Liverpool.......is 11 feet 3 below mean sea-level.
" " " .... Kingstown, Dublin Bay, .. 5 " 5 " " " "

The inequality of sea-level is permanent both at high tide and low in the Irish Sea Basin. The greater rise on the British side seems to be due to the fact that that side lies open to the direct line of pressure coming from the Atlantic. But in both channels, specially St. George's Channel, the direct effect of that line of pressure is seen in the relatively enormous rise at the Welsh ports compared with the diminutive rise at the Irish ports of Wexford and Arklow. The key to the position lies in the geographical formation of both channels.

We find that the height to which tides rise and the depth to which they fall is purely a geographical question. The rule is:

As mean low water falls below mean sea-level, so mean high water rises above mean sea-level.

Lord Kelvin, however, suggested another rule in his "Navigation":

> "Why," he asked, "have we tides of twenty to forty feet in some places and only two or three feet in others? Because the waters have not time in twelve hours to take the equilibrium form." (Page 165.)

The figures in the Irish Sea table conflict with Kelvin's theory. As for the two and three feet tides the conflict is as great. For example:

Mean rise at Ballycastle Bay........2 feet 1
Mean rise Mull of Cantyre...........3 " 4

The two stations are some twenty miles apart and co-tidal; yet the Scottish station receives fifty per cent. more water than the Irish. The facts of the Bay of Fundy also conflict; we observed its forty-feet floods succeeded immediately by forty-feet ebbs.

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* The figures 10 feet 4 at Dublin refer to Poolbeg Light.

The tides of nature are visible and not invisible. They disclose themselves in a twofold action: first, current speed; secondly, speed of moving masses; the current speed is slow, but that of masses in motion is fast. For example:

Tide is high at Albany 9 hours 33 after Governor's Island, New York; but the current does not travel there at fifteen miles an hour. There is nothing occult about the masses in motion; the movement is visible and demonstrable. When a basin rises to high level the visible rise on the shore is slow, and likewise at ebbs the visible fall is slow. The fastest-known current occurs in the bore of the Tsien-Tang-Kiang, and its maximum speed, for a very short distance only, attains the enormous rate of eleven miles an hour.

With regard to its cause, we believe that problem is now solved by geographical analysis. The problem of double tides is also solved by the same analysis, and likewise the problem of the Mediterranean tides. All of these problems are, confessedly, insoluble by mathematics.

We have also observed that the rotation of the earth has no visible effect on tides; we have not found one case of acceleration or retardation that could reasonably be attributed to rotation on either side of the Atlantic, or anywhere on the globe; not even excepting the Chinese bore — which Mr. Darwin claims as due to rotation.

We have also observed that distance from the Equator avails nothing, for tides rise as high in Arctic regions as in Equatorial.

We deny the claim of theory that Atlantic tide-waves travel from the Pacific, and hereby challenge a demonstration.

There is a vast difference in the visible appearance of tides in the two oceans; in the one comparative regularity, in the other an exceedingly great irregularity.

Finally, we demand a separation of the tidal-lunar relationship, because there is no scientific proof of relationship.

As more accurate observation, some fifty years ago, wrested weather from supposed lunar control, so more accurate observation of tide, now, must sever the antiquated, unscientific relationship.

The case is a case of facts versus fancies, of observed gravitational pressure versus undemonstrated lunar attraction.

At the dawn of the twentieth century, after a guardianship of two centuries, the masters of the science confess that the actual tides of nature are insoluble by mathematics!

November, 1900.

THE POPULATION OF THE UNITED STATES

BY

HENRY GANNETT.

The population of the United States, the several States and the Territories, by the Twelfth Census, taken as of date June 1, 1900, was announced by the Census Office on October 30. Details regarding the population of certain States and of all cities having a population of 25,000 or more have also been given out in bulletins by that office.

By this Census are included in the population all human beings in the country, instead of excluding, as heretofore, Indians not taxed and whites on Indian reservations, leaving to Congress the duty of determining what shall constitute the representative population. From the population may be excluded aliens, Indians not taxed, *i.e.*, those under tribal relations, and illiterates in those States which have made literacy a qualification for suffrage, besides the inhabitants of the Territories, thus reducing the representative population considerably below the total population.

The population of the United States on June 1st last was 76,304,799. This includes the population of Hawaii, but not that of Porto Rico or the Philippines. The increase over the corresponding figures of 1890 was 13,235,043, or about 21 per cent. Between 1880 and 1890 the per cent. of increase was 24.86, thus showing that the rate of increase has suffered a decided diminution during the past ten years. Such a diminution is, however, to be expected as being in accordance with the general principle that as population increases, other things being equal, its rate of increase constantly tends to diminish. Moreover, during the last decade there has existed a specific reason for the reduction in the reduced immigration. During the decade between 1880 and 1890, 5,250,000 immigrants cast in their lot with us—a most unprecedented number; while during the decade just past the number of immigrants was reduced to 3,890,000—a diminution of 1,360,000. Whatever may be the effect of immigration upon the number of inhabitants and the rate of increase in the long run, there is no question but that a sudden change in it is immediately felt.

The following table shows the population of the the States and Territories in 1890 and 1900, with the numerical increase, the rate of increase during the decade, and the number of inhabitants to a square mile in 1900:

	POPULATION, 1900.	POPULATION, 1890.	GAIN.	Percentage of Gain.	Density of Population.
Alabama	1,826,697	1,513,017	313,680	21	35
Alaska	63,441	32,052	31,389	98	. .
Arizona	122,931	59,620	63,311	105	1
Arkansas	1,311,564	1,128,179	183,385	16	25
California	1,485,053	1,208,130	276,923	23	9
Colorado	539,700	412,198	127,502	31	5
Connecticut	908,355	746,258	162,097	22	182
Delaware	184,735	168,493	16,242	10	92
District of Columbia	278,718	230,392	48,326	21	city
Florida	528,542	391,422	137,120	35	10
Georgia	2,216,331	1,837,353	378,978	21	38
Hawaii	154,001	89,990	64,011	71	23
Idaho	161,772	84,385	77,387	92	2
Illinois	4,821,550	3,826,351	995,199	26	86
Indiana	2,516,462	2,192,404	324,058	15	70
Indian Territory	391,960	180,182	211,778	118	13
Iowa	2,251,853	1,911,896	339,957	18	40
Kansas	1,469,495	1,427,096	42,399	3	18
Kentucky	2,147,174	1,858,635	288,539	16	54
Louisiana	1,381,625	1,118,587	263,038	23	34
Maine	694,466	661,086	33,380	5	23
Maryland	1,190,050	1,042,390	147,660	14	120
Massachusetts	2,805,346	2,238,943	566,403	25	351
Michigan	2,420,982	2,093,889	327,093	11	42
Minnesota	1,751,394	1,301,826	449,568	35	22
Mississippi	1,551,270	1,289,600	261,670	20	34
Missouri	3,106,665	2,679,184	427,481	16	45
Montana	243,329	132,159	111,170	82	2
Nebraska	1,068,539	1,058,910	9,629	1	14
Nevada	42,335	45,761	loss 3,426	0	0
New Hampshire	411,588	376,530	35,058	9	46
New Jersey	1,883,669	1,444,933	438,736	30	251
New Mexico	195,310	153,593	41,717	27	1
New York	7,268,012	5,997,853	1,270,159	21	151
North Carolina	1,893,810	1,617,947	275,863	17	39
North Dakota	319,146	182,719	136,427	75	5
Ohio	4,157,545	3,672,316	485,229	10	101
Oklahoma	398,245	61,834	336,411	544	10
Oregon	413,536	313,767	99,769	32	5
Pennsylvania	6,302,115	5,258,014	1,044,101	20	140
Rhode Island	428,556	345,506	83,050	27	390
South Carolina,	1,340,316	1,151,149	189,167	16	45
South Dakota	401,570	328,808	72,762	22	5
Tennessee	2,020,616	1,767,518	253,098	14	48
Texas	3,048,710	2,235,523	813,187	36	12
Utah	276,749	207,905	68,844	33	3
Vermont	343,641	332,422	11,219	3	38
Virginia	1,854,184	1,655,980	198,204	12	46
Washington	518,103	349,290	168,813	48	8
West Virginia	958,800	762,794	196,006	26	38
Wisconsin	2,069,042	1,686,880	382,162	23	38
Wyoming	92,531	60,705	31,826	52	1

The average number of inhabitants to a square mile in the main body of the country, excluding Alaska, Hawaii, Porto Rico, and the Philippines, was 25. In 1890 it was 21, showing an increase of four inhabitants per square mile.

The density of population ranged widely in different States—from one approaching the conditions in the most populous of the countries of Europe down to practically unsettled conditions. Leaving out of account the District of Columbia, which is substantially a city, the most densely-populated State was Rhode Island, with 390 persons to a square mile. This was closely followed by Massachusetts with 351. No other State had as many as 300, and between 200 and 300 to a square mile was New Jersey only; having between 100 and 200 persons to a square mile were five States—Connecticut, Maryland, New York, Ohio, and Pennsylvania. At the other extreme was Nevada, with only one inhabitant to three square miles.

The greatest numerical gain was made in New York, with more than one and a quarter millions; next Pennsylvania came, with more than a million; and Illinois, with nearly a million. The increase in these three States formed about one-fourth of that of the entire country. The increase in the single State of New York was greater than that in all the western States combined, and that in Pennsylvania about equal to it; while that in the little State of Massachusetts was more than half as great. In Nevada alone was there a loss. The highest percentage of gain was in Oklahoma—544 per cent. Three Territories—Arizona, Indian Territory, and Oklahoma—more than doubled in population; while Alaska, Hawaii, Idaho, Montana, North Dakota, and Wyoming added more than 50 per cent.

For discussion of these figures the States may be grouped in five divisions, which present characteristic differences, as follows:

North Atlantic, including New England, with New York, New Jersey and Pennsylvania;

South Atlantic, including the States bordering the Atlantic Ocean south of Mason and Dixon's line and including the District of Columbia and West Virginia;

North Central, including the States north of Ohio River and the south boundary of Missouri and Kansas, extending from Ohio west to include Kansas, Nebraska and the Dakotas;

South Central, including the States south of the last group and extending from Alabama westward to include Texas and Oklahoma;

Western, including all the States and Territories west of the above two groups.

The North Atlantic group is far the most densely settled, has much the largest proportion of urban population, and its industries consist primarily of manufactures and commerce. In the North Central group the density of population ranges widely from east to west, being dense in the eastern States and sparse in the western, which have many of the characteristics of the frontier. It contains a considerable proportion of urban population, but by no means as great as in the North Atlantic group, and its industries are, on the whole, agricultural, although manufactures and commerce are rapidly developing in the eastern part. These two groups of States receive nearly all the immigration, and consequently contain nearly all the population of foreign birth.

The South Atlantic group is predominantly agricultural, contains few cities of magnitude, and its manufacturing and commercial interests are comparatively slight. It contains a large proportion of negroes. It is a well-settled agricultural region.

The South Central group differs in different parts, like the North Central group, being well settled in the eastern part and sparsely settled toward the west, where it has frontier characteristics. It contains a trifling proportion of urban population, little manufactures, and is pre-eminently an agricultural region. This also contains a large proportion of negroes.

The Western group is, on the whole, sparsely settled, but it contains a diversified population, with a few large cities and many small ones, and has a diversity of interests, including grazing, farming, mining, manufactures, and commerce. It is in a very early stage of development, and at the same time all branches of industry are well represented. From the fact that it is sparsely settled its normal rate of growth is rapid.

The proportion of the population which is contained in each group of States is shown below:

	PER CENT.
North Atlantic	27
South Atlantic	14
North Central	35
South Central	19
Western	5
	100

The following table shows the proportional share of each group of States in the country's increase:

	PER CENT.
North Atlantic	28
South Atlantic	12
North Central	30
South Central	22
Western	8
	100

From the above it is seen that 58 per cent. of the entire gain of the country was made by the two groups of northern States, and that 34 per cent., or a little over one-third, was made by the two southern groups, while the western group received about one-twelfth of the entire gain made by the country.

The Atlantic States—which are, with the single exception of Florida, the thirteen original States, and those formed from them, Maine, Vermont and West Virginia—received two-fifths of the country's gain in population.

Similar percentages in 1890 show that the distribution of population among these different groups of States has suffered but slight change. The North Central group has lost one per cent.; while the South Central group has gained one per cent.—these being the only changes made as between these groups of States during the decade.

The following are the percentages of increase of the several groups of States:

	PER CENT. OF INCREASE.
North Atlantic	21
South Atlantic	18
North Central	18
South Central	27
Western	35

From the above it is seen that the North Atlantic States, although the most densely settled, show a rate of growth more rapid than either the South Atlantic or the North Central States. This comparatively rapid rate of growth is due to the fact that these States, as a whole, have got their second wind, so to speak; have changed their industry from agriculture, for which they were over-populated, to manufactures, for which they were rather sparsely settled, and are now in process of filling up under the new class of industries, thus conforming themselves to this new set of conditions. This is seen more clearly if we consider individual States. Massachusetts and Rhode Island, which are par excellence manufacturing States, gained respectively at rates of 25 and 27 per cent.; New Jersey, a manufacturing and commercial State, 30 per cent.; New York, mainly commercial, 21 per cent., and Pennsylvania, in great part a mining and manufacturing State, 20 per cent. On the other hand, Maine and New Hampshire, in which manufactures have not yet made great progress, gained only 5 and 9 per cent. respectively, and Vermont, which is still in the agricultural stage, gained but 3 per cent.

The distribution of these gains between city and country will be discussed later.

The North Central States, on the other hand, are in part in a transition stage, being well populated for agriculture; but not having yet developed manufactures to any considerable extent, certain of them are in a state of depression incident to such conditions. Such is the case in Ohio, Indiana, Michigan, Wisconsin, Iowa, and Missouri. The great gain in Illinois is due to the phenomenal growth of the city of Chicago, and by no means to the development of the rural districts. Waiving this, not one of these States has grown at a rate equal to that of the country at large. The western portion of this group, however, being sparsely settled, would have grown rapidly during the last decade had it not been for unfortunate conditions peculiar to this region.

In the later years of the decade between 1880 and 1890 a great movement of population took place to the middle and western parts of Kansas, middle Nebraska, and the Dakotas, in the semi-arid regions, which was induced by a succession of wet seasons. This was accompanied by a great increase in land values, both in rural districts and in cities. The existing cities were greatly increased in population, and hundreds of new cities were founded. All this region witnessed a tremendous boom. A succession of dry seasons followed, which literally starved out the settlers, and the country was depopulated even more rapidly than it was settled. In 1885, at the beginning of the boom, Kansas had a population of 1,268,530; in 1888, near its crest, its population numbered 1,518,552; in 1890, by the Federal Census, it was 1,427,096, and in 1895 only 1,334,734. Thus the State gained in three years nearly 250,000 inhabitants, and subsequently lost nearly 200,000. These movements were not confined to the semi-arid belt, but were felt in all parts of the State. Measurably, the same thing took place also in Nebraska and the Dakotas, and these States are now slowly recovering from the effects of this boom.

The South Atlantic States are mainly agricultural, and are quite fully populated for that industry; moreover, their growth is handicapped by the fact that they have been engaged for nearly a century in sending forth their children to populate the frontier regions to the westward, without any compensation in the form of immigration, which the North Atlantic States have enjoyed.

Among these States are Delaware, whose rate of increase was 10 per cent.; Maryland, with 14 per cent.; Virginia, with 12 per cent.; North Carolina, with 17 per cent., and South Carolina, with 16 per cent.—all less than the average of the country. Georgia reaches the average of the country, because of its mines and its newly-acquired manufacturing industries; while Florida, in spite of disastrous frosts, goes far beyond it with 35 per cent. This is because it is a sparsely-populated frontier State, now in process of filling up. West Virginia owes its rapid rate of increase—26 per cent.—in great part to the development of its immense coal deposits.

The South Central States present conditions similar, in many respects, to the North Central States, the eastern ones being quite well populated for the predominant agricultural industry, while the westernmost are now in process of filling up.

Alabama, Mississippi, and Louisiana have grown at rates equal to or slightly above that of the United States; while the States north of them—Kentucky, Tennessee and Arkansas—have grown much more slowly. In the cases of Kentucky and Tennessee this is probably due to their density of population—54 and 48 to a square mile—and to the character of their industries, which are still largely agricultural. Arkansas may have been seriously drained to fill Indian Territory and Oklahoma, both of which have filled up at a phenomenal rate, their rates of increase being respectively 118 and 509 per cent. It is interesting to note that, while the lands of Indian Territory are held in common by some 56,000 Indians, there are settled upon them not less than 335,000 whites, most of whom are "intruders" and squatters. Texas, with a vast area of unoccupied land, has been filling up rapidly.

The Western States, in spite of the depression which they have suffered through the demonetization of silver, have grown at a surprisingly rapid rate, although not as swiftly as in the preceding decade. Every one of these States, with the exception of Nevada, has gained at a more rapid rate than the country at large. Nevada, dependent entirely upon its mines, with very little water to make its fertile soils available for agriculture, has for many years been in a failing condition. Idaho, Montana, and Arizona have grown at very rapid rates. Colorado, Wyoming, and Utah have made excellent gains, considering the prevailing conditions of business. New Mexico, long settled by a population of Mexican descent, is using most of its available water supply in irrigation, and has made comparatively small gains. On the coast, California has gained the least, and Washington the most. Of the three States, probably Washington can sustain by agriculture the largest population in comparison with area, as it has a more ample rainfall.

The following table exhibits the rank of the States and Territories in 1900 and 1890.

	1900.	1890.
1.	New York.	New York.
2.	Pennsylvania.	Pennsylvania.
3.	Illinois	Illinois.
4.	Ohio	Ohio.
5.	Missouri	Missouri.
6.	Texas	Massachusetts.
7.	Massachusetts.	Texas.
8.	Indiana.	Indiana.
9.	Michigan	Michigan.
10.	Iowa	Iowa.
11.	Georgia	Kentucky.
12.	Kentucky	Georgia.
13.	Wisconsin	Tennessee.
14.	Tennessee	Wisconsin.
15.	North Carolina	Virginia.
16.	New Jersey	North Carolina.
17.	Virginia	Alabama.
18.	Alabama	New Jersey.
19.	Minnesota.	Kansas.
20.	Mississippi	Minnesota.
21.	California	Mississippi.
22.	Kansas	California.
23.	Louisiana	South Carolina.
24.	South Carolina	Arkansas.
25.	Arkansas.	Louisiana.
26.	Maryland	Nebraska.
27.	Nebraska	Maryland.
28.	West Virginia	West Virginia.
29.	Connecticut	Connecticut.
30.	Maine.	Maine.
31.	Colorado	Colorado.
32.	Florida	Florida.
33.	Washington	New Hampshire.
34.	Rhode Island	Washington.
35.	Oregon	Rhode Island.
36.	New Hampshire	Vermont.
37.	South Dakota	South Dakota.
38.	Oklahoma.	Oregon.
39.	Indian Territory	Dist. of Columbia.
40.	Vermont	Utah.
41.	North Dakota	North Dakota.
42.	Dist. of Columbia	Indian Territory.
43.	Utah	Delaware.
44.	Montana	New Mexico.
45.	New Mexico	Montana.
46.	Delaware.	Idaho.
47.	Idaho	Oklahoma.
48.	Arizona	Wyoming.
49.	Wyoming.	Arizona.
50.	Alaska	Nevada.
51.	Nevada.	Alaska.

Out of the 51 States and Territories, 15 have retained their relative rank, including the 5 largest. Massachusetts, in spite of her great gain in population, has dropped from 6th to 7th place, having been passed by Texas. Kentucky and Georgia have changed places, to the advantage of the latter State; Tennessee and Wisconsin have also similarly exchanged positions; Virginia has dropped two places, and New Jersey has risen a similar amount. Kansas has gone down from 19th to 22nd, having been passed by Minnesota, Mississippi, and California. New Hampshire has dropped from 33rd to 36th, and Vermont from 36th to 40th. The most phenomenal rise in the list is that of Oklahoma—from 47th to 38th place.

The cities containing a population of 25,000 and over numbered, in 1900, 159, with a total population of 19,694,625, or 26 per cent. of the total population. In 1890 the same cities had a combined population of 14,855,489, or 24 per cent. of the population; and in 1880, 9,933,927, or 20 per cent. The increase in these cities during the past ten years is thus less than in the decade between 1880 and 1890. The total increase in population of the United States from 1890 to 1900 was 13,235,043. Of this number the increase in these 159 cities was 4,839,136, or nearly 37 per cent. of the increase of the country. In several of the States the increase in their cities of 25,000 or more inhabitants formed nearly all of the increase of the States, showing that the smaller cities and the rural districts were nearly at a standstill. Thus, in New York State the increase in the cities of 25,000 or more inhabitants constituted 90 per cent. of that of the entire State; indeed, the increase in New York City alone was nearly 75 per cent. of that of the State. In Illinois the increase in the cities constituted 65 per cent. of that of the State, and here again a single city, Chicago, was responsible for not less than three-fifths of the State's increase in population. In Rhode Island the increase in these cities constituted 76 per cent. of that of the State; while in the City of Providence alone the gain was 52 per cent. of that of the State. In Ohio the increase in the cities was 62 per cent. of that of the State, in Massachusetts 68 per cent., in New Jersey 55 per cent., in Connecticut 63 per cent., and in Pennsylvania 53 per cent.

Excluding the population of these cities from that of the country in 1890 and in 1900, the remainder of the population made a gain of only 15 per cent. during the decade, or less than half that made by these cities.

Of these 159 cities, one, New York, had a population of 3,437,202, making it the second city of the world in population and the first city of the world which exists under a single municipal organization, since London is in organization not a single city, but a group of cities. Besides this, Chicago and Philadelphia exceeded a million each in population. Three cities follow them, with population exceeding half a million, viz.: St. Louis, Boston, and Baltimore. Including these six cities, there were in 1900 thirty-eight cities exceeding 100,000 inhabitants each—an increase of ten during the decade.

The cities were distributed very unequally over the country, the

North Atlantic States containing not less than 51 per cent., or more than half of the urban population under this definition. The North Central States contained 31 per cent., the two sections composing the Northern States containing, therefore, more than four-fifths of the urban population of the country; the South Atlantic States contained only 7 per cent., and in the South Central States only 6 per cent. was found, while the Western States contained but 5 per cent.

Similar differences between the sections of the country are seen in respect to the proportion of the population which was contained in these cities. Thus, in the North Atlantic States 48 per cent., or nearly one-half of the population, was contained in their cities of 25,000 or more; in the North Central States 23 per cent.; while in the South Atlantic only 12 per cent. was contained in these cities, and in the South Central only 8 per cent. and 25 per cent. of the population of the Western States was urban.

The following table shows the changes in rank of the cities of 100,000 or more inhabitants between 1890 and 1900:

RANK OF CITIES OF MORE THAN 100,000 INHABITANTS.

	1900.	1890.
1.	New York	New York.
2.	Chicago	Chicago.
3.	Philadelphia	Philadelphia.
4.	St. Louis	St. Louis.
5.	Boston	Boston.
6.	Baltimore	Baltimore.
7.	Cleveland	San Francisco.
8.	Buffalo	Cincinnati.
9.	San Francisco	Cleveland.
10.	Cincinnati	Buffalo.
11.	Pittsburg	New Orleans.
12.	New Orleans	Pittsburg.
13.	Detroit	Washington.
14.	Milwaukee	Detroit.
15.	Washington	Milwaukee.
16.	Newark	Newark.
17.	Jersey City	Minneapolis.
18.	Louisville	Jersey City.
19.	Minneapolis	Louisville.
20.	Providence	Omaha.
21.	Indianapolis	Rochester.
22.	Kansas City	St. Paul.
23.	St. Paul	Kansas City.
24.	Rochester	Providence.
25.	Denver	Denver.
26.	Toledo	Indianapolis.
27.	Allegheny	Allegheny.
28.	Columbus.	
29.	Worcester.	
30.	Syracuse.	
31.	New Haven.	
32.	Paterson.	
33.	Fall River.	
34.	St. Joseph.	
35.	Omaha.	
36.	Memphis.	
37.	Los Angeles.	
38.	Scranton.	

Nine of the above cities, including the six largest, maintained the same rank. San Francisco and Cincinnati each fell two places, their positions being taken by Cleveland and Buffalo; New Orleans and Pittsburg exchanged places; Washington fell below Detroit, and Milwaukee and Minneapolis below Jersey City and Louisville; Providence gained four places, and Indianapolis five places. The most striking feature of the table is the great drop in Omaha, which fell from 20th to 35th place.

The following table shows the population of these cities, with their increase and the rate of increase.

CITIES.	1900.	INCREASE FROM 1890 TO 1900.	
		Number.	Per cent.
New York, N. Y	3,437,202	944,611	37.8
Chicago, Ill	1,698,575	598,725	54.4
Philadelphia, Pa	1,293,697	246,733	23.5
St. Louis, Mo	575,238	123,468	27.3
Boston, Mass	560,892	112,415	25.0
Baltimore, Md	508,957	74,518	17.1
Cleveland, Ohio	381,768	120,415	46.0
Buffalo, N. Y	352,387	96,723	37.8
San Francisco, Cal	342,782	43,785	14.6
Cincinnati, Ohio	325,902	28,994	9.7
Pittsburg, Pa	321,616	82,999	34.7
New Orleans, La	287,104	45,065	18.6
Detroit, Mich	285,704	79,828	38.7
Milwaukee, Wis	285,315	80,847	39.5
Washington, D. C	278,718	48,326	20.9
Newark, N. J	246,070	64,240	35.3
Jersey City, N. J	206,433	43,430	26.6
Louisville, Ky	204,731	43,602	27.0
Minneapolis, Minn	202,718	37,980	23.0
Providence, R. I	175,397	43,451	32.8
Indianapolis, Ind	169,164	63,728	60.4
Kansas City, Mo	163,752	31,036	23.3
St. Paul, Minn	163,065	29,909	22.4
Rochester, N. Y	162,608	28,712	21.4
Denver, Colo	133,859	27,146	25.4
Toledo, Ohio	131,822	50,388	61.8
Allegheny, Pa	129,896	24,609	23.3
Columbus, Ohio	125,560	37,410	42.4
Worcester, Mass	118,421	33,766	39.8
Syracuse, N. Y	108,374	20,231	22.9
New Haven, Conn	108,027	26,729	32.8
Paterson, N. J	105,171	26,824	34.2
Fall River, Mass	104,863	30,465	40.9
St. Joseph, Mo	102,979	50,655	96.8
Omaha, Nebr	102,555	37,897	26.9
Los Angeles, Cal	102,479	52,084	103.3
Memphis, Tenn	102,320	37,825	58.6
Scranton, Pa	102,026	26,811	35.6

It is seen that the gain in New York City alone is nine-tenths as great as that in the whole group of Western States.

In nearly every State the cities of 25,000 inhabitants or more, collectively, have increased in population more rapidly than the remainder of the State. This is the case with all the North Atlantic States, with the exception of Vermont, which contains no large cities; with the North Central States, with the exception of the

Dakotas, which contain no large cities; of Nebraska, whose large cities were, it is said, *padded* in 1890; and of Minnesota, in which agricultural interests are still increasing rapidly.

In most of the Southern States, also, the cities have grown more rapidly than the remainder of the State; but the reverse is the case in West Virginia, where mining is causing rapid development, and in South Carolina, whose only city is Charleston, whose commercial development is extremely slow. The reverse is the case, also, in Louisiana, where, although New Orleans, its sole large city, shows a fairly rapid growth, the remainder of the State is filling up fast, owing to the stimulus afforded by fertile cotton and sugar lands. In Mississippi, Indian Territory, and Oklahoma there are no large cities. Among the Western States and Territories, Wyoming, New Mexico, Arizona, Idaho, and Nevada contain no large cities. In Colorado and Utah the cities have not grown as rapidly as the remaining parts of the State, although both city and State have increased with more than the average rapidity.

If we now make a closer separation between the urban and the rural elements of the community, classifying as urban all dense bodies of settlement numbering 8,000 or more, and regarding the remainder as rural, we find that in every New England State, together with New York, the rural element has lost in numbers during the past decade, all the gains made in these States being in the cities. The losses in the rural portions are not in any case great, but they are sufficient to show unmistakably that, so far as the industry of agriculture goes, these States are finished, and their progress hereafter is to depend, as it has for some decades past, upon manufactures and commerce—industries which are pursued only in cities. In Pennsylvania and New Jersey there has occurred some increase of the rural element—an increase only a fraction as great, however, as that of the urban element. Going farther west, in Ohio, the increase in the rural element was but 2 per cent.; in Indiana but 1 per cent.; in Michigan, 8 per cent.; in Illinois, 9 per cent., and in Iowa 14 per cent.—showing a gradual increase in the rate of growth of the rural element as we go westward and northward into regions more sparsely settled and more favorable for agricultural pursuits.

In the Southern States the gain in the rural districts does not differ greatly in any case from the gain in the cities.

This is but an amplification of the proposition laid down in the discussion of the rates of increase of the total population of these States.

NOTES ON GEOGRAPHICAL EDUCATION.

BY

RICHARD E. DODGE.

Geographical Memoirs for Teachers' Uses.—The New Jersey Geological Survey published several years ago a special memoir on the Physical Geography of New Jersey, for the use of teachers in the State. This memoir was an exhaustive and detailed study of the physical features of New Jersey, perhaps too detailed for the uses of general teachers, but yet on the right lines. It furthermore emphasized through its appearance the increased public interest in good geography teaching. Another similar report was published by the State of Missouri (see this Bulletin, XXIX, 2), and proved very successful.

The most recent instance of State interest in geography teaching is in the case of Wisconsin, where the Geological and Natural History Survey has established an Educational Series of Bulletins, of which the first has appeared this year. This Bulletin is by Professor Rollin D. Salisbury, of the University of Chicago, and Mr. W. W. Atwood, of the Chicago Institute, and is devoted to the geography of the region about Devil's Lake and The Dalles of the Wisconsin, with some notes on its surface geology. The Bulletin is a handsomely illustrated and well-printed large octavo volume of 150 pages, divided into five chapters, as follows: General Geographic Features; Outline of the History of the Rock Formations which show themselves at the Surface; General Outline of Rain and River Erosion; Erosion and the Development of Striking Scenic Features; The Glacial Period. All the chapters deal especially with the region in question except III, in which the development of streams is considered in detail, with illustration from Wisconsin. This chapter is a very good and readable summary of the principles of planation, and is a good reference for teachers outside of Wisconsin.

Valuable and stimulating as the Bulletin is, it is to be criticised, as was its predecessor in New Jersey from Professor Salisbury's pen, as available for the specially-trained teacher only. The material is too technical for the teacher without special training in geography, and cannot, except in its illustrations, be of great assistance to a large number of teachers. It is to be hoped that future attempts along this line may be more generally usable, without losing any scientific value through simplification and popularization.

THE SECONDARY SCHOOL COURSE AT THE CHICAGO INSTITUTE.—The courses of study in all branches of the Chicago Institute are particularly interesting from the standpoint of geography, owing to the amount of attention that is given to the earth sciences in the secondary course, as well as to the almost unique plan for elementary school work. In each of the four years of the high school there is a year course in some earth science, so that the course as a whole for the twelve years of the elementary and secondary school follows one unified, progressive plan. It is evident, however, from a study of the outlines thus far published, that the other groups of sciences do not receive an equally strong or just amount of attention. The plans for the elementary, secondary, and pedagogic schools will appear monthly in the *Course of Study*, Chicago Institute, Academic and Pedagogic, for sale by the Institute.

In the elementary course very emphatic attention is given to physical geography, so that a good foundation is laid for scientific work in the high school. The first year, called ninth grade, is devoted to the study of the Physiography of the Land, including particularly the physiographic processes and their results as seen about Chicago and in other parts of the world. The work is largely based on field trips about Chicago, and is more advanced in its point of view than would be advocated by many for a course in the last year of the high school.

The second year is devoted to meteorology and to palæontology. The meteorology, so far as outlined, will be based largely on observational work about Chicago, and opens with considerations of the constituents and distribution of the atmosphere, followed by temperature and pressure.

The third-year course deals with geology, particular emphasis being devoted to the historical aspects. The work opens with a study of rocks and rock structures, followed by a study of the development of the leading physiographic regions of the eastern United States. This will be in turn followed, according to announcement, by historical geology and a study of continental evolution.

In the fourth-year course, entitled anthropogeography, it is intended to summarize and apply the principles of the first three years, as seen in the study of nations and peoples in relation to their environment.

In the work as outlined for each month references are given to the best text-books and sources of collateral reading, though it should be noted that the books are not always accurately listed as to title, etc. The plans for the year, when complete, will be of great value to all teachers, for the whole field of earth sciences will be so presented that any teacher can see it as a whole with ease.

The course as presented is widely at variance with the possibilities in most secondary schools, and will undoubtedly meet with much adverse criticism. The experiment will be watched with great interest by all concerned in secondary work, because of the inkling that it ought to give as to the abilities of pupils in the first years of the secondary school to deal satisfactorily with certain aspects of the earth sciences, that many teachers believe have but small reason for being studied *in extenso* in high schools.

GEOGRAPHICAL EDUCATION AT THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1900.—The British Association for the Advancement of Science devotes an increasing amount of attention each year to problems in education. In fact, the problems have become so important in the work of the Association that all the sections have petitioned the Council to establish an educational section. The geographical section has long given a dignified place to educational papers by setting aside one session for their presentation. In 1900 two papers were given in this session, and elicited an interesting discussion.

The first paper was devoted to Progress of Geographical Instruction in Elementary Schools, particularly as evidenced by the success of the efforts in the West Riding of Yorkshire in carrying out the reforms recommended by the Royal Geographical Society some years ago. The principal advances announced by the author, Mr. T. G. Rooper, an inspector of schools, are well summarized by the following extract from the report given in the Geographical Journal for October:

> The chief reforms consisted in the intelligent study of local geography through local maps and models, and in object lessons which explained the principles of physical geoprahy. The reliefs and models led up to the art of reading maps and to the demand for better maps. Such lessons were an excellent introduction to reasoning, and proved how little there was that was purely arbitrary even in the sites of towns and villages in the neighbourhood, much less in the industries which were carried on in them. The necessity for good wall-maps was now apparent, and correctly drawn details were demanded in place of vague and inaccurate sketches. The symbols on the wall-map were vague and meaningless unless a context and significance were given them by previous practice in the building up of local plans and maps. The scholar had to be taught with care how to translate the symbols of the

wall-map back into the forms of nature which they, however inadequately, represented. The value of graphic work in teaching geography was insisted on. The mere copying and coloring maps of various parts of the world was rather an exercise in drawing than in geography. Each map should be drawn to serve some definite purpose. It should disentangle from a complex whole some particular part which analysis brought to light and illustrate it with precision and simplicity. Further, the sketch-maps should proceed from simpler studies to more complex, and no map should be made of a country as a whole until the leading features had been dealt with separately, and thus the "constructive" method of teaching geography was introduced. In conclusion, the formation of local geographical societies for educational purposes was recommended, and an account was given of the formation and working of the Southampton Geographical Society.

The second paper, by Mr. E. G. Wethey, was devoted to the teaching of commercial geography, which has very evidently become more rationalized in Great Britain than in the United States, in consequence of the unremitting efforts of a few leaders in the field—like Mr. Chisholm, Dr. Mill, and Dr. Herbertson. The author described his methods in detail, and exhibited a large series of original lantern-slides devoted to this topic.

PHYSICAL GEOGRAPHY IN THE HIGH SCHOOL.—Two recent papers from the pen of Professor W. M. Davis, of Harvard University,* deserve attentive reading by all interested in geography in the secondary schools.

The first paper is devoted to a discussion of the logical scope of secondary school physiography, to a consideration of the most modern and most culture-bearing point of view, and to an outline of the topics that may, to the author's mind, be rightfully included in the course. The second article treats of "practical exercises," including suggestions for laboratory work in reference to the topics selected in the first article, and closes with a statement of the present and future place of geography in the school curriculum.

Professor Davis supports strongly the scope of secondary school physical geography as outlined by the sub-committee of the Committee of College Entrance Requirements† and approved and published by the Association as "the physical environment of men," under which the principal headings are "the earth as a globe, the atmosphere, the oceans, and the lands."

Considering the point of view that obtains in reference to physical geography, the author shows how the subject has profited from the application of the theory of evolution—primarily contributed from geology and biology—and then shows that modern physical geography differs from the old, especially in two phases; first, that

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* Physical Geography in the High School, *School Review*, Vol. 8, Nos. 7 and 8, September and October, 1900, pp. 388–404; 449–456.

† *Journal of School Geography*, Vol. II, September, 1898, pp. 248–262. *Proceedings National Educational Association*, 1898, pp. 973–984; 1899, pp. 780–799.

> in the earlier books, explanation was offered only for the more active phenomena, such as winds, currents and volcanoes; geographical features that were not evidently the result of active processes were merely described. In the newer books the attempt is made to extend explanation uniformly all over the field of study;

and secondly, that every item is presented

> as an element of the environment in which the life of the earth has been developed, and by which it is still conditioned at every turn. This second test of modernized treatment is as valuable as the first.

Continuing, the author remarks in reference to the increased value that comes from such a point of view:

> When the applied treatment of the subject is understood it will be recognized that plants, animals, and man should not be given special chapters for themselves in the modern limitation of the contents of physical geography, for the very sufficient reason that mention of them is distributed all through the subject. Gravity determines the "standing" position of plants and animals. Latitude and longitude should be taught as devices by which man takes advantage of the form and rotation of the earth to determine his position on it, not as abstract mathematical problems. The chapters on temperature and moisture give opportunity for mentioning many appropriate consequences as to the distribution of plants. Under the description of the shallow border of the oceans, where the waters lie upon the so-called "coastal shelf," proper opportunity is found for referring to these waters as the habitat of food fishes, and therefore as valuable fishing grounds. A general account of the larger land-forms leads up to the control exerted by continents, mountains (especially the Himalaya) and deserts (especially the Sahara) upon the distribution of man and animals. Under mountains reference is made to their significance as refuges for conquered tribes or peoples. Avalanches and landslides are not finished with a description and explanation of inorganic phenomena alone; they are also presented as dangers to which people living in mountain valleys are subjected. Here we may well introduce Guyot's eloquent sentence as a practical guide in our work: "To describe without rising to the causes or descending to the consequences is no more science than merely and simply to relate a fact of which one has been a witness." The phrase "causes and consequences" thus comes to serve as a touchstone by which both the explanatory and the applied treatment of the subject may be easily tested.

With such an understanding of the field, special chapters on man, animals, and plants are not logical or necessary, however much conservatism may demand their inclusion in a text-book from the standpoint of sales, and it is to be noted that the author has followed this plan in his own well-known text-book for secondary schools. Similarly, the author does not believe in including areal geography in a course that is primarily given from the standpoint of causal relations rather than of space.

Following these introductory paragraphs, the author outlines in some detail his views of the topics rightfully to be included under the headings—The Atmosphere, The Ocean, Activities of the Lands, Features of the Lands, The Waste of the Land, Climatic Control of Land-Forms.

In the second paper, the contents of which have been sufficiently noted above, the author closes with the following "belief" in reference to the place of general physical geography in the school curriculum:

> My belief is that the subject will not remain very long in the better high schools, and that, as it descends into the grammar schools, its place will be taken by elective courses near the end of the high-school course. The reasons for this belief are as follows: First, a number of good grammar schools are already teaching, under "geography" or "physical geography" much material recommended in the National Educational Association report as appropriate for the first year of the high school. Second, the rapid improvement of the grammar-school course in general geography, by omitting much old memoriter work and compressing the valuable remainder into shorter time, is actually providing a place for physical geography in the last year of the grades. Such a change must come to be generally approved when it is seen how large a part of elementary physical geography is within reach of the grammar schools, and when it is remembered that every study thus added to the lower grades reaches a vastly greater number of school children than it would reach in the high school. Still more important is the third and final reason, namely, a growing belief that the existing method of teaching geography in the grades is not rational enough to stimulate as fully as it should the mental activity of school children; the remnants of traditional methods in geography by which young intelligence is often hampered should therefore be replaced by an increasing attention to explanatory and practical methods, such as the subject of physical geography affords in an admirable way. For the present, the establishment of a good course in physical geography in the first high-school year is probably the best general plan; but it is not likely that the subject will hold a permanent place there. Ten years hence, elementary physical geography will have found its way into many grammar schools; twenty or thirty years hence, the high school that has physical geography in its first year and not in its third or fourth will be considered old-fashioned.

THE SIZE OF ELEMENTARY GEOGRAPHY TEXTS.—The recent appearance of the Tarr and McMurry series of geographies in octavo form marks the first American success in publishing an elementary geography smaller than quarto size, and has aroused much interested speculation and comment. Other publishers have considered the possibility of an octavo series, and have feared that the strength of public opinion did not warrant the experiment. The objections to the reduction in size have been varied, and some of them curious, the greatest objection being that it would be impossible to print the necessary maps in octavo size. Though the recent attempt has not wholly succeeded in reference to the maps, it has shown that good and workable maps can be printed in octavo size. Perthes' *Taschen-Atlas* (Gotha), however, presents an ideal in reference to octavo maps toward which American publishers should push as rapidly as possible. Perhaps the most curious objection to the decrease of size, and one that has great weight in certain quarters, is that pupils no longer have any receptacle in which to carry loose papers between school and home.

While this attempt has been in progress in America, it is very interesting to note that in England there is an equally strong prejudice against increasing the size from octavo to quarto, and combining the atlas with the text. The English adaptation of Frye's Geography, published as the *Illustrated School Geography*, by Andrew J. Herbertson, was the first large-sized school geography in England, and was severely criticised as regards size and weight. Not only in England but in France and Germany the most used texts are of small size. Kirchhoff's *Erdkunde*, in two volumes, is large octavo, but contains no atlas, the student being expected to use some school atlas like that noted above. Foncin's *Géographie*, in four volumes, though not octavo, is very much smaller and of less weight than our school geographies; the maps therein are cheaply printed, and are not poor because of the size of the book. The smallest set of school geographies known to the writer is that in use in the schools of New Zealand—a set of five, each approximately 7 x 5 inches, and the largest containing but 100 pages. The maps in this series are black and white outline maps entirely.

Considering the widespread use of small school geographies the delay in their appearance in this country is absurd. In the course of time, with greater experience in map-making, it is to be expected that the old-fashioned geography will be a thing of the past, as it deserves to be.

MAP NOTICES.

BY

HENRY GANNETT.

THE ACTIVE INTEREST which has recently been awakened in forests and forestry has received another illustration in the issue by the Geological Survey of the State of a series of forest maps of New Jersey. The first of these represents the entire State upon a scale of five miles to an inch, showing, by shades of color, the proportion which the wooded areas bear to the total area.

The principal wooded area of New Jersey is in its southern, level part. South of latitude 40° 20′ these plains are almost solidly covered with forest, principally, if not entirely, of yellow pine. The secondary area is in the ridges and hills of the northern part of the State, especially near the boundary with New York. Here also the proportion of timber land runs very high.

Besides this map the Geological Survey has issued six sheets, upon a scale of one mile to an inch, showing in detail the wooded areas of the northern half of the State.

These maps accompany reports upon the woodland and forests of the State, by Mr. C. C. Vermeule, Gifford Pinchot, and others, constituting the greater part of the Annual Report of the Survey for the year 1899.

The Transcontinental Triangulation and the American Arc of the Parallel. Special Publication No. 4, U. S. Coast and Geodetic Survey. Washington. Government Printing Office. 1900. Quarto, pp. 870. With Many Cuts and Other Illustrations and Two Maps.

The measurement, by geodetic methods, of the arc of the parallel of 39° north latitude within the limits of the United States was commenced in 1872 and completed in 1898—a period of twenty-seven years. The eastern end of this arc is at Cape May, N. J., in longitude 74° 56′, and the western end at Point Arena, Cal., in longitude 123° 42′. The length of the arc is 2,625 miles, or, in longitude, 48° 46′. This is the longest arc of a meridian ever measured by any one Government, and its measurement is one of the most important, if not the most important, contribution to a knowledge of the shape and size of the earth which has ever been made. Moreover, this belt of triangulation provides no fewer than sixteen

States with a fundamental and reliable basis for the extension of topographic surveys.

In the course of this work ten base-lines have been measured and expanded, viz.: on Kent Island, Md., which is the most eastern; at St. Albans, in West Virginia; at Holton, Ind., Olney, Ills., and in the American Bottom in the same State, opposite St. Louis; at Versailles, Mo., Salina, Kan., Colorado Springs, Colo., Salt Lake, Utah, and the Yolo base in the Sacramento Valley of California.

Altogether 308 stations have been occupied in the triangulation. At 109 stations the latitude has been determined astronomically, at 73 stations azimuth has been determined, and at 37 stations longitude has been determined by the use of the telegraph.

The eastern portion of this belt passes mainly through a country of wooded hills and mountains—the Appalachians, which present many serious difficulties, though none of them were new to the men engaged upon the work. The central portion is through a region partially timbered—prairies, or barren plains—and here the difficulties were not great. Through both these sections the distances between stations are comparatively small, but in the western portion of the belt—that is, from the Rocky Mountain front in Colorado west to the Pacific coast—the conditions are quite different. The stations consist almost entirely of high mountains, ranging from 9,000 to 14,000 feet, and more, in altitude. The figures are large, the distances between stations being, on an average, fully 100 miles, and in one case—from Uncompahgre Peak, in the San Juan Mountains of Colorado, to Mount Ellen, in the Henry Mountains of Utah—the distance is approximately 180 miles.

The adjustment of the system has been made simply. After making the station adjustments, the figure forming the expansion about each base-line was adjusted by itself; then each belt of triangulation connecting one base expansion with the next was adjusted to itself and to the adjusted base expansions at its extremities.

It has been found, as a result of this measurement, that the form and dimensions of the 39th parallel within the United States do not conform either to the Clarke or the Bessel spheroid, but that it lies between the two. An interesting incident connected with the results is the fact that the difference in station error between Colorado Springs, at the east base of the Rocky Mountains, and Salt Lake City, at the west base of the Wasatch Mountains, is, upon the Clarke spheroid, not less than 46″, or nearly three-fourths of a mile. This difference is, of course, easily accounted for by the topographic surroundings of the two places.

Throughout the work differences of altitude were carefully measured by the method of zenith distances, and thus a continuous series of altitudes was carried across the continent.

During these twenty-seven years there has been expended upon the triangulation the sum of $500,000, in addition to the salaries of the men engaged upon it. The cost per linear mile of triangulation in such regions as Maryland and Delaware, which consist of partially timbered, rolling country, was $103; while in California, where the stations were upon high mountains and where large figures were employed, the cost was $463. Measured by the areas included, however, the result is quite different. Thus, in Indiana and Illinois, a partially timbered and rather level region, the cost was $11 per square mile; while in Colorado, where the stations were high and lines long, the cost was only about $2 per square mile. Measured by the cost per station occupied, the results again are different. In Indiana and Illinois the cost per station was $1,725; while in Colorado it was not less than $6,131.

In conclusion, mention should be made of the fact that the reductions of the geodetic work and the publication of the book have all been effected within the short space of two years from the completion of the field work—a most notable example of rapidity of execution and publication.

BOOK NOTICES.

La Face de la Terre, by Ed. Suess, translated under the direction of E. De Margerie. Vol. II, 8vo, 878 pp.: Colin & Cie., Paris.

This work is a translation of *Das Antlitz der Erde*, by Ed. Suess, Professor of Geology in the University of Vienna. Volume I of the translation appeared in 1897. In the general preface contained in that volume M. Bertrand affirms that when the history of geology shall be written this work of Suess will be placed at that stage of the creative days when light was. This is no doubt extravagant; but we need not debate upon another passage of the preface—"A work of prodigious learning;" and we may well follow Professor B. K. Emerson—"A suggestion of Suess must be carefully considered, even if it be marvellous." * No other work so fully summarizes the physical history of the globe, and its value for reference and study depends little upon the ultimate validity of even its main theories.

The thesis of the volume before us is, that widespread risings and fallings of the sea, rather than oscillations of the land, have, throughout geological time, controlled the changes of shore-lines and have been the landmarks of terrestrial history. The first chapter deals with the history of opinion on this subject. Among the authors quoted in support of the continental oscillation or secular movement theory we find: Playfair holding to real elevation of the land in Sweden; and Von Buch saying, after his researches in Lapland, "the level of the sea cannot sink;" these being later supported by the powerful authority of Lyell, Darwin, and Dana. But our author follows a long line of observers and speculators in asserting the mutability of the sea-level. De Maillet ascribed the retreat of the sea to progressive diminution of its volume; Swedenborg noted that the sea sinks more in northern than in southern regions, and gave clear expression to the doctrine of change of form in the liquid envelope; Cuvier, and Brongniart, arguing from alternations of marine and fresh-water deposits about Paris, believed in a primal sea, which retired, made way for fresh waters, and returned, to retire yet again; Robert Chambers thought that the English sea terraces might be due to the rising and sinking of distant sea-bottoms; Belt held to a swelling of equatorial waters; and Trautschold has not ceased to affirm, in the face of prevailing opinion, that secular movements of continents are not real. It should be added that in this chapter, as throughout the volume, the references to the literature are full, exact, and of great value.

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* Bull. Geol. Soc. Am., Vol. XI, p. 93. Presidential Address.

Extended chapters are given to an account of the form of the Atlantic and the Pacific shore-lines, and these are followed by detailed study of the ancient seas—Paleozoic, Mesozoic and Tertiary—showing the history of widespread transgressions and recessions in past ages.

Among the prevailing arguments for the theory of secular oscillation, we shall notice three, and observe the author's treatment of them. Of the proofs of continental elevation none has been urged with more confidence than elevated beaches, such as appear about the British Isles, along the shores of the Scandinavian peninsula, and in many other parts of the world. Where these are truly marine they may as readily be due to a rising sea as to a sinking land. But in the author's view suitable discrimination as to origin of these so-called elevated shore-lines has not been made. He devotes an extended chapter to the shore-lines of Norway. Petersen's observations in the neighborhood of Tromsö show fragmentary lines ascending, staircase fashion, as one goes up the fiords. Sexe pronounces contrary to the hypothesis of elevation because the height and number of beaches in the same fiord, or in different ramifications of the same fiord, are not invariable. In general, on the open sea the terraces are not far from the mouths of existing streams. In many side valleys of Hardanger fiord, for example, the number of levels varies from two to five.

Terraces often lead up to a moraine, which in turn has a lake behind it. Helland has shown that this association of moraines with terraces is true of nearly fifty of the chief lakes of the country. Most of the terraces of Norway must, therefore, in the author's view, be explained as evidences of the retreat of the glacier, the exception being in case of elevated beach-lines with marine shells.

The Baltic and North Sea are considered at length. Local or temporary influences are here efficient, also. As stated, for the Baltic we have atmospheric pressure, heating by the sun, ebb and flow due to winds, and, besides such seasonal changes, oscillations of a longer period, negative movement of the sea predominating.

Even fiorded coasts are not admitted as proofs of subsidence. Referring to such off-shore submerged channels as that of the Hudson, comparison is made with similar channels in Lake Geneva and Lake Constance, due, as the author holds, on authority of Forel and others, to recent erosion by deep currents. Likewise, the submerged channel of the Congo is explained as due to sedimentary accumulation on either side. It is hardly needful for us to comment upon the difficulties entailed by such interpretation of the "drowned" margins of many lands.

For many years the remains of the Temple of Jupiter Serapis have stood as a classical proof of oscillations within historic time, or rather within the span of the Christian era. But our author will not allow this. It is but a local phenomenon. The movements here differ from those on the Baltic. They belong to the sudden and intermittent type:

> They are changes which take place in the surface parts of a chimney clogged with ashes, and neither the fresh verdure of the hills and plains, nor the careless and light-hearted animation of the inhabitants, nor historic memories should let us forget that this "little corner of pleasant land," as Horace said, the Promontory of Misenum, lies in the abyss of a volcano which is extinct, but not wholly cooled.

While thus a strenuous attempt is made to break the force of the ordinary arguments for secular oscillations of the land, a much larger body of the work, even, is devoted to two positive considerations, which the author holds to be fatal to the generally received theory. Here we have, first, a comparison of the contours of the Atlantic and Pacific Oceans, and, second, the widespread and uniform shiftings of relative level in geological time.

The Atlantic and Pacific borders are reviewed in great detail. The Atlantic borders are compared, showing some differences and some striking correspondences. Thus, Greenland is taken as the axis of symmetry. Then, on the east, we find a chain of ancient gneiss extending from Lapland to the Hebrides, and on the west a jagged chain of gneiss from Davis Straits to the Straits of Belle Isle. On the east, likewise, is the great Baltic shield (Paleozoic), and on the west the Canadian shield. Other correspondences are the pre-Permian mountains of Ireland, Cornwall, and northwestern France, and the Appalachians. Also we find the two great Mediterraneans of the east and the west. Some elements appear in Europe for which there is no equivalent on the west. Such are the pre-Devonian Caledonian chain and the Pyrenees. Summing up (p. 331): with the exception of the Cordillera of the Antilles and of the mountainous fragment of Gibraltar, bordering the two Mediterraneans, the external border of a folded chain does not form any part of the contours of the Atlantic.

For the Pacific the facts are in strong contrast (pp. 334–5). With the exception of a fragment of the coast of Central America in Guatemala, where the turning Cordillera of the Antilles is submerged, all parts of the Pacific border whose geology is known are formed by chains of mountains folded toward the ocean in such fashion that their external wrinkles serve as a limit to the continent itself, where they form a girdle of peninsulas and aligned islands.

This contrast between the two oceans as respects their continental borders is held to be inconsistent with the theory of secular oscillations, as are, further, the widespread and uniform transgressions and recessions of the sea during geological time. Such oscillations cannot explain the repeated submersions and emergings of the lands. The changes observed are far too extended and much too uniform to be able to proceed from movements of the solid crust. Thus the transgressions of the Cretaceous, observed upon the Amazon, Athabasca and the Elbe, on the borders of the Nile and in the Tarim Basin, in the valley of the Narbadá and in Borneo, on the isle of Sakhalin and upon the banks of the Sacramento—these are changes which have affected the entire surface of the planet. Similar is the evidence from Paleozoic times. The positive and negative phenomena alternate in the same epoch, and one is not able to explain this fact by the uprising of the land. During the Carboniferous and other periods the solid crust has undergone vigorous foldings; but these phenomena have nothing in common with these general changes of relative level. Here we have explained the possibility so remarkable, that we are able to use the same terminology to distinguish sedimentary terrains in all parts of the globe. The movements of the sea, to which changes of level are ascribed, are held to be oscillatory, and the principal cycles of oscillation embrace within their range minor or secondary cycles of change.

The author's theory must now be briefly outlined. Some areas of the sea-bottom sink and the water-level is drawn down; hence, though the sinking be local, the subsidence of water-level is general. The continental areas are left behind and bear the character of horsts.* Such negative movements are relatively sudden. The chief fields of sinking were toward the south, and running down between them, where they merge, we find the pointed southern extremities of Africa, India, and Greenland.

But how are the positive movements explained? Here the tireless processes of denudation and transfer of land-waste to the sea are called forward. By this means the sea-bottom is aggraded and the water-level raised, this going on ever slowly, as distinguished from the more abrupt negative movements.

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* A horst is a region or block of country left at a considerable altitude by the subsidence of surrounding areas.

Many supplemental factors are cited, but hardly with such definiteness as to meet the conclusions of varied and refined observations upon changes of level going on in recent decades and centuries. Thus the height of the sea is said to depend on many conditions—solar heat, atmospheric pressure, prevailing winds, influx of fresh water, evaporation, local attraction, and many other circumstances. The average level is hard to determine, and needs a long series of observations. This is especially the case as regards the influence of winds, and, indeed, of all the meteorological factors. The tides, being periodic, can be eliminated. Actual dislocations or oscillations are admitted as occasionally occurring, as in the uplift by Cook Strait in the New Zealand earthquake of 1856.

This review has aimed only to set forth some of the chief points of Suess' theory, which are urged with great wealth of learning and illustration. Perhaps first among the objections that will rise in the mind of every American student will be the tiltings or differential movements of large areas, such as are demonstrated by the deformed ancient beaches of the Great Lakes or by the widely variant present altitudes of the Cretaceous deposits of the Great Plains.

A. P. B.

A Reader in Physical Geography for Beginners, by Richard Elwood Dodge, Professor of Geography in the Teachers College, Columbia University, 237 pp.: Longmans, Green and Co.

This little volume deserves attention at the hands of all teachers of geography. As stated by the author in his preface, only an account of the more important principles is attempted, the aim being to set forth the conditions of human life as depending on physical features. It is designed for use in connection with a text-book. In this manner it will supply new points of view and fresh illustration of many themes. Teachers who are still obliged to use antiquated text-books will find the Reade respecially helpful as a supplement. This is the more true because the most modern views of the development of the lands are treated with simplicity and in entire avoidance of difficult or technical conceptions. The author has been successful in writing for beginners, and wholly avoids condescension in meeting his young readers.

The main topics are: The World as a Whole; The Continents; The Industries of Men; The Origin of Land-Forms; The Great

Land-Forms; Climate; and other important physical features influencing man. There is much fresh and helpful illustration; thus, in giving to weathering its due weight in denudations:

> Sometimes the river is likened to a railway train that receives and carries all freight delivered to it, and the atmosphere and gravity to the farmers who prepare the freight for shipping and take it to the train.

Equally good is this of meander curves:

> The country boy living near a stream knows the deep part of the stream as his swimming pool, the sandy or gravelly slope on the inside of the curve as his out-of-door bath-house, and the steep bank, perhaps, as a diving-board.

We may further cite the reference to the camper and canoer's language, the "rapids and reaches" of a river; the "tying and untying" of islands by the sea; the flat-iron as illustrating glacial work (p. 125); the drumlin as shaped like half a foot-ball; the alluvial fan as an open-air delta; and the volcanic plug, resembling the cork in a bottle. Every teacher knows the value of such comparisons drawn from common experience. Space will not admit of quoting here the admirable description of wave-action on the sea-shore (p. 101). There are 89 well-selected pictorial illustrations, mainly from photographs.

A. P. B.

Cabot Bibliography, with an Introductory Essay on the Careers of the Cabots, Based upon an Independent Examination of the Sources of Information, by George Parker Winship. London, Henry Stevens, Son & Stiles, 39 Great Russell Street, over against the South-west Corner of the British Museum. New York: Dodd, Mead & Company, MDCCCC.

This work is the extension of a small Cabot bibliography prepared for use during the celebration of the four hundredth anniversary of John Cabot's visit to North America.

The effort has been to include a description of every publication which has influenced noticeably the popular or the scholarly conceptions of John and Sebastian Cabot, or which is likely to prove useful to those who wish to study the careers of the Cabots and their contemporaries.

It does not appear that Mr. Winship has neglected any source of information in his difficult task, and students will remain under obligation to him. His annotations are interesting—one, on page 174, especially so to New Yorkers:

> TRUAX (CHARLES H.) Opinion by the court, in case of Mortimer *et al.* v. New York Elevated Railroad Company *et al.* . . . . .
>
> The court, having carefully examined BANCROFT, No. 248, BRYANT AND GAY,

No. 288, and especially Mrs. MARTHA J. LAMB'S *History of New York*, expressed the legal decision that as a result of Cabot's discovery of North America in 1497 on behalf of England, the English common law, and not the Dutch Roman law which lurked in the hold of Henry Hudson's vessel when he first explored Manhattan bay, determined the relation of abutters to the use and enjoyment of the public streets. Heavy damages were therefore awarded against the Elevated Railway Company.

The Introductory Essay tells the story of the Cabots with care and impartiality. Mr. Winship writes of Sebastian in particular, *studiis odiisque carens*, and, with the exception of one passage, this is the tone of his book. He says on page xxxii:

> The Spanish historians, cognizant of their national characteristics, have been the first to suggest the probability that Sebastian Cabot, a foreigner in high position, found his work made difficult by a lack of confidence and co-operation on the part of his Spanish associates and subordinates.

Is jealousy of a foreigner in authority over themselves a characteristic of Spaniards rather than of Englishmen, or Germans, or Frenchmen? By no means; the characteristic is human, not national, and to assume the contrary smacks of self-righteousness.

Author, printer, and publisher have done their best for this beautiful book.

Bibliotheca Açoriana. Noticia Bibliographica de Escriptos nacionaes e estrangeiros concernentes ás Ilhas Dos Açores. Vol. II, por Ernesto do Canto. Typ. de Eugenio Pacheco, Ponta Delgada. 1900.

It is ten years since Senhor do Canto published the first volume of his bibliography of works relating to the Azores. In this long interval of time he has continued his researches, finding a rich vein of information in the previously unexplored files of the periodical press of the Islands. His first thought, as the materials accumulated under his hand, was to bring out a second edition of the original book; but it seemed better to print this second volume.

The work is well done, though in this, as in too many bibliographies, one sighs for a sufficient authority to draw the line. If every publication is to be registered, what is to become of mankind? Life is too short for these things. A journal that lived for eight weeks in the year 1888 might be left to its long sleep.

The *Bibliotheca* is fairly printed, but on paper too thin to be read with pleasure.

TWO CARTOGRAPHIC PRODUCTIONS.

To the Secretary American Geographical Society :

DEAR SIR:

Referring to the letter of Mr. O. B. Ireland, published in No. 2 of this year's BULLETIN of the Society, in which he complains of the inaccuracy of geographical maps published by some of the leading railroad companies of the United States, and points out the misinformation likely to be inculcated into the minds of the young students from the study of the same, may I be permitted to draw attention to two most excellent cartographic productions, from the study and use of which I have derived much profit and no end of enjoyment in the pursuit of geographical studies ?

Among makers and publishers of maps in Europe none are better known than the firm of JUSTUS PERTHES, in Gotha, Germany. Some of the most famous geographers and cartographers have worked for this publishing house, and names such as Stuelpnagel, Berghaus, Petermann, Stieler, Sydow and, more recently, Habenicht, Vogel, Wagner, Lueddecke, and Langhans are too familiar to need further mention. From this house came to us the well-known *large Stieler Atlas*, and the equally good small *Perthes pocket atlases* (five in number), which are designated by Mr. Hugh Robert Mill in his recent "*International Geography*" as the MOST PERFECT POCKET ATLASES KNOWN.

The firm of Justus Perthes has recently published two large charts of the world, one of which appeared a year or two ago in an improved edition under the title "*Dr. Berghaus' Chart of the World*," revised and brought up to date by H. Habenicht and B. Domann. The *second map*, published this year, is compiled by *Dr. Paul Langhans*, the author of a very useful *Commercial Atlas of the World.*

The Berghaus Chart gives a comprehensive exhibit of the chief regular commercial routes traversed by ocean steamers and sailing vessels of all nations, also the principal overland railroad lines, the telegraph and ocean cable systems, etc. In order to be of universal service in all countries of the globe, *the map was edited in the English language.* It forms a handy and indispensable companion in the offices of merchants, railroad men, maritime offices, civil engineers' offices, but is likewise adapted for libraries, colleges, schools, as well as on board of vessels of the merchant marine and navy. The chart is drawn on Mercator's projection, owing to which fact the countries of the higher latitudes are shown on a greatly increased scale, and with a great fullness of detail.

The study of geography may be pursued either with the assistance of a terrestrial globe or by using reference maps and atlases. Large wall maps are, in many respects, superior to large atlases, because one is enabled to find everything on one map, without being compelled to turn over the pages of sometimes cumbersome books. Of maps suitable for applied or commercial geography, those based on Mercator projection are, for many reasons, the handiest. While they do not represent the areas on a uniform scale—those between 60 degrees latitude and the poles becoming very much exaggerated in size—the proportion between width and length is everywhere correctly maintained. As is well known, the areas increase in charts drawn on Mercator's projection in proportion to the square of the secant of the latitude ϕ, or as $1 : \cos.^2 \phi$; *i. e.*, degrees of latitude are increased on the map in the same proportion as the degrees of longitude diminish on the sphere. Hence the Mercator projection shows countries and oceans truthfully as to form, while the scale varies in different parts of the map. Such charts are particularly adapted for purposes of navigation, for, owing to the fact that the meridians and parallels of latitude are drawn in straight lines, the course of a ship between two ports can be also drawn straight.

The Berghaus chart is beautifully engraved and shows the chief topographical features of the land, besides being full of information regarding the oceans. On the land the map shows the rivers, canals, cataracts, rapids, swamps, docks, coaling stations, treaty ports, altitudes in metres above sea-level. The different colonial possessions—British, German, French, Portuguese, Italian, Dutch, Danish and Spanish—are shown in different colors. On the water it shows the routes actually used by the principal steamship lines and sailing vessels, which are numbered and arranged in a list by continents and nationalities. It gives the tracks of outward and homeward-bound steamers, including the distances in nautical miles and the time required for the voyage; the summer and winter routes of sailing vessels, the warm and cold ocean currents, with their mean velocity; the limit of pack ice, the average and extreme limit of drift ice or of icebergs; the reefs, sandbanks and shoals dangerous to navigation, the occurrence of sea-weed, the date boundary line in the Pacific Ocean, the 200-metre (approx. 100 fathoms) line of sea soundings.

A smaller inset map gives a good representation of the countries and seas around the poles, drawn on Lambert's polar projection; another smaller map shows the principal telegraph and cable lines, a third one is entitled a wind chart. The lines of magnetic variation are also indicated, also the hours of high water, the surf-bound coasts, strong tidal streams, etc. The longitude is designated east and west from Greenwich, by degrees and also in time, and on the latitudes the duration of longest days in months, days and hours is given. In the Berghaus chart the American continent is placed in the centre of the map, which when mounted measures 61½ by 37 inches, but which can also be had as a folded map, 8 by 10 inches in size, the price varying from 20 to 24 marks.

The second wall map, by Langhans, which is 63 inches by 42 inches in size, mounted, is somewhat cheaper, being printed instead of engraved, the price, mounted, being 12 marks. On this chart, which is also represented on Mercator's projection, the longitude of Greenwich, or the zero line, is placed in the centre of the map, and on the left is shown the American continent and a part of the Pacific Ocean, while to the right we find Asia and Australia, and the western half of the Pacific Ocean, including Japan and the Philippine Islands. Though this map has special reference to German commerce and trade, and to the German colonies, it is equally well adapted for general geographical purposes. The Berghaus chart is, perhaps, more replete with information, but on the other hand the Langhans chart is much more clear and comprehensive, the lettering is large and more easily read at a distance, and the author seems to have studied hard to omit all unnecessary matters and to include all points of chief importance. For German mercantile firms this map is invaluable, because it gives not only the principal German steamer lines, but also all German consulates, all Custom-houses and treaty ports. In showing the principal rivers the aim was in each case to show by special marks the limits of their navigability.

It is difficult to express a preference between these two well-executed new maps, for each has its special adaptation and its advantages. Readers interested in geography would do well to examine and compare both maps before making a choice.

Very truly yours,

WM. PAUL GERHARD, C.E.,

Member American and National Geographic Societies.

M. FROIDEVAUX'S PARIS LETTER.

PARIS, November 18, 1900.

The Universal Exhibition of 1900 is closed, and in the first days of October the series of International Congresses, which had succeeded each other without interruption from the beginning of June, came to an end.

The work of these Congresses is of undoubted importance; but to speak of it with precision and with sufficient knowledge we must wait for the publication of the detailed reports. We already possess the summary of the proceedings at one of these—the Congress of Colonial Sociology—but the discussions of this body are uninteresting from a geographical point of view, and we should not speak of them in this place but for the fact that the United States have taken rank among the colonial Powers.

Notwithstanding the close relation which binds colonization to geography, this correspondence is devoted to geography, and especially to the geographical questions which interest the savants and the public in France. It is impossible to treat these without alluding to the different geographical institutions, official or private, which exist in France. I propose to explain the nature of these institutions, their organization and their work, and to begin with the Committee on Historical and Descriptive Geography.

This takes the first place, because it is composed of the heads of all the French geographical services and of some among the masters of geographical science and instruction. It was formed in 1885, up to which time there was no geographical section recognized in the plan of the Committee on Historical and Scientific Work, organized in 1834 under the Ministry of Public Instruction. In 1883 geography was admitted into the section of the Natural Sciences; but practical experience showed the defects of this arrangement, and the Minister of Public Instruction, M. René Goblet, established a section (the fifth) devoted entirely to the geographical sciences.

Under its first president, Vice-Admiral Jurien de la Gravière, this section of Historical and Descriptive Geography found itself charged with the publication of many original documents, as well as with the continuation of the work left unfinished by the Commission on Historical Geography of Ancient France.

Before long it began to make its influence felt among geographers, and this has continued to increase in a marked degree under the presidency of M. Schefer and M. Bouquet de la Grye. This influence is due: 1st, to the sound and impartial criticism of *all* the publications of the French geographical societies, and to the counsel conveyed in the printed reports on the subject of these publications and others submitted to the examination of the Committee; 2d, to the control exercised by the works annually brought before the section of Historical and Descriptive Geography in the Congress of Learned Societies; 3d, to the list of questions drawn up every year in view of this Congress and distributed by the Ministry of Public Instruction to all the learned societies of the nation.

Thanks to the sound advice of the Section, a number of provincial societies have abandoned the practice of printing the lectures delivered before them by travellers, perhaps for the twentieth time, and have applied the larger part of their resources to the careful study of their own district, producing in this way, within the past ten years, and publishing contributions of very real worth. The list of questions prepared by each Congress has had an analogous result.

The most important of these contributions are published, with the minutes of the monthly meetings of the Section and the reports of the members, in the *Bulletin de Géographie Historique et Descriptive*, an annual octavo volume of more than 400 pages, with plates and maps.

Edited from the beginning by the Secretary, Dr. E. E. Hamy (Curator of the Trocadéro Ethnographical Museum, Professor of Anthropology in the Museum of Natural History, and member of the Institute), the fourteen volumes of the *Bulletin* contain a vast number of articles on France and the French colonies, as well as on other countries, besides studies in ethnography and papers on the history of geography and cartography.

The Section publishes also a series of quarto volumes, such as: *La Mission Scientifique dans la Haute Asie*, edited by M. Grenard from the notes of the regretted Dutreuil de Rhins, and the *Mission en Indo-Chine*, of M. Pavie; the *Asie Centrale*, of Dutreuil de Rhins, and *L'île Formose*, by the late Imboult-Huart; *Les Séricigènes Sauvages de la Chine*, by M. A. A. Fauvel, and *La Sculpture sur Pierre en Chine au temps des deux dynasties Han*, by M. Edouard Chavannes. These two series represent a great deal of labour on the part of the members of the Committee. There is hardly a meeting of the Section at which reports are not presented by Messrs. Bouquet de la Grye, Maunoir, Hamy, Aymonier, Henri

Cordier, Grandidier, Levasseur, Gabriel Marcel, Emm. de Margerie and other eminent men.

The most important geographical occurrence since the date of my last letter is the meeting at Paris (Sep. 25–Oct. 6) of the International Geodetic Association. This, the thirteenth session, was under the presidency of M. Faye. Besides the reports on geodetic operations accomplished since 1898, there was read to the Association a communication from Mr. Gill, Astronomer of the Observatory at the Cape of Good Hope, on the progress of the work for the measurement of a meridian arc of 104 degrees in Africa, between the Cape and Alexandria.

Five degrees in Rhodesia and three and a half in Natal have already been measured, and the Association expressed the wish to see the African work completed by the measurement of an American arc of the same extent. M. Oudemans even proposed the measurement of an equatorial arc from the French Congo to German East Africa; but this was held to be premature. After an investigation of the causes of the divergence in the results obtained in 1888, and again in 1892, by the English and the French observers for the difference of longitude existing between Paris and Greenwich, the Association learned with satisfaction that the operation would be begun anew in 1901. Great interest was displayed in a communication made by Gen. Bassot on the measurement of the arc in Peru, undertaken by the Geographical Service of the army. Between 1736 and 1743 the Academicians Bouguer, Godin, and La Condamine measured an arc of three degrees at Quito. The preliminary operations accomplished by Capts. Maurain and Lacombe permit us to think that an arc of six degrees may be measured in the territory of Ecuador. This work, which will require four years of steady application, will be under the control of the Academy of Sciences.

Questions of oceanography are attracting attention, and a Society has been founded at Bordeaux for the study of the oceanography of the Bay of Biscay. It has already completed two series of soundings at the entrance of the channels of the Gironde and in the outer basin of Arcachon, and it proposes to follow a systematic plan of dropping floats in the Bay. This Société d'Océanographie du Golfe de Gascogne is the organization of Messrs. Charles Bénard and Camena d'Almeida.

There are numerous explorations in Africa, such as Lieut. R. de Segonzac's reconnaissance in southwestern Morocco, fertile in results; the march to the Adrar, under the lead of the unfortunate

Paul Blanchet; and in the French Congo, Capt. E. Jobit's reconnaissance of the lower Likuala and Dr. A. Cureau's three years' travels on the upper Ubanghi. Both of these explorers have published their accounts in *La Géographie.*

The Geographical Service of the Army has lately issued a good account of the Chinese province of Chihli, based upon the reconnaissances of Lieut.-Col. d'Amade, and M. A. Leclère has sent very important communications on the provinces of the Empire bordering on Tonkin.

In America M. A. Cerceau, who has been engaged since 1891 in exploring the wide territory of Bolivia, has discovered regions hitherto unvisited in the Chaco and eastern Bolivia. He reports the existence of rock salt, galena, gold, sulphuret of mercury, tin, graphite, kaolin and platina, which the Indians disdain as a kind of *iron heavier than gold.*

M. de Gerlache, commander of the *Belgica* Antarctic expedition, will start early in December for the Kerguelen Islands, to make an attempt at colonisation. His steam yacht will be accompanied by a sailing vessel, and scientific observations will be made during the stay at the Islands.

Of the recent publications on the French colonies the monographs on Algeria claim the first place, and one of these, the *Historique de la Pénétration Saharienne*, by M. Augustin Bernard and Capt. N. Lacroix, gives in less than 200 pages a clear comprehension of the different phases through which the exploration of the Sahara has passed since 1830; and the authors, in closing, trace the programme of the future expansion of France in that vast region. Another remarkable book is that of M. Edmond Doutté on *L'Islâm Algérien en 1900.* The author studies the Mohammedan religion as it exists throughout Maghreb, and especially in Algeria. He shows that the marabouts form the chief element and constitute the strength of the religious fraternities in the country. These latter are without cohesion and hardly wear the aspect of disciplined secret societies, and they obey with reluctance the impulses coming from the East. Several among them have rendered eminent service to the French, as set forth in the seventh chapter of M. Doutté's work.

Among monographs on the other French colonies particular mention must be made of the three volumes on Senegal, in which the resources of the colony are treated with thoroughness; the agriculture by M. Perruchot, the botany by M. Chevalier, and the ethnography by Dr. Lasnet. It must be said, however, that the physical geography has not been touched.

The same omission is to be noted in the handsome volume on *Le Tonkin en 1900*, by M. Robert Dubois.

Historical geography and archæology are not without representation. *L'Algérie par ses Monuments* is principally interesting for its illustrations, but a more serious value attaches to *L'Algérie dans l'Antiquité* by M. Gsell; and not less interesting is M. Al. Gayet's thin book on *L'Itinéraire des Expéditions de Jean de Brienne et de Saint-Louis en Egypte*—an excellent commentary on the photographs and sketches exhibited in the pavilion of the Catholic Missions at the Exposition.

Something may be said of a question much debated during the year. As long ago as 1827 the reality of Chateaubriand's travels in America was called in question, and recently, in two articles printed in the *Revue d'Histoire Littéraire de la France*, M. Joseph Bédier has taken up the subject. He affirms that Chateaubriand made use of the books of previous travellers, and that it was materially impossible for him, during his short sojourn in America, to accomplish the journeys described. The Abbé Bertrin replies in the *Correspondant*, maintaining the genuineness of Chateaubriand's journey. I think as he does; but the matter will remain in doubt, unless a happy chance should bring to light the manuscript authentic text, not improbably in America.

HENRI FROIDEVAUX.

NOTES AND NEWS.

THE ANNUAL MEETING of the Society will be held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, January 22d, 1901, at 8.30 o'clock, P.M. The order of Proceedings will be:

Election of Fellows.
Reports of Council and Treasurer.
Report of Committee on Nominations.
Election of Officers.

A. F. Schauffler, D.D., will read a lecture on Constantinople, with illustrations.

At the regular meeting, on the 20th of February, Mr. George F. Becker, of the U. S. Geological Survey, will read a paper on the Philippine Islands.

SURVEYS MADE by the ship *Nero*, for two years past, under orders of the Navy Department, for the purpose of laying a telegraph cable between the United States and the Philippine Islands, have added to the knowledge of the abyss in the Pacific on the route between the Midway Islands and the island of Guam. This abyss was previously known to be rather more than 1,900 fathoms in depth, but on the westward voyage of the *Nero* 4,913 fathoms of line were run out in an attempt to sound without reaching bottom.

In further explorations of this Nero Deep, as it is now called, Commander Hodges found bottom at 5,160 fathoms and 5,269 fathoms.

MR. G. MELVILLE BOYNTON, of Coaldale, Pleasant Valley, Hayden Creek Mining District, Colorado, sends the official map of his projected route to the North Pole by the air-ship *Columbia.*

This ship will be constructed at Coaldale, and the expedition will start on or about July 15, 1903, from Cape McClintock, Parry Islands, for the North Pole, and thence to North Cape, Spitzbergen.

IT IS ANNOUNCED that Captain J. E. Bernier, of Quebec, has the support of the Royal Geographical Society for a North Pole expedition. He hopes to be aided by the British Government.

Captain Bernier will travel by the route taken by the wreck of the Jeannette. He says:

> In the Polar Circle, from off the shores of Siberia, the most frequent winds are from the east and southeast, thus carrying the ice to the north and northwest and

drawing it against the shores of Franz Josef's Land, Spitzbergen and Greenland. In the Polar Circle, on the North American coast, on the contrary, the wind blows from the west and northwest, pushing the ice to the east and southeast, on the shores of North Greenland and Grinnell Land, where it accumulates from year to year and forms those eternal masses, or "hummocks," which Markham, who explored this part of the Polar Circle, says tower many feet above the moving ice. If we draw a line from Behring Strait to North Greenland we divide the Polar basin into two parts. The western part is formed of an immense block of ice bearing upon the shore of North America, which forms an impassable barrier to the pole. The eastern portion is formed by ice which has drifted from the coast of Siberia and Behring Strait, and pursues the course of the wind. When it approaches the pole it increases in thickness and volume, forming the "hummocks," which Dr. Nansen found to be about thirty feet high. These are no doubt higher nearer the pole.

Captain Bernier believes that the polar basin is a frozen ocean, over which his dogs and reindeer may make their way on ice, for the most part, free of impediment. He purposes to enter on the Siberian side, near the Lena, or Bennett Island, and proceed at the rate of four miles a day. He will take 120 reindeer and a rubber raft capable of carrying 18,000 pounds, thirty sledges made of aluminum and wood, and food enough to last two and a half years, though he believes he will return in eighteen months. The members of the expedition are to be the commander, one geological surveyor, six selected men, and one man to take charge of the dogs and reindeer. The captain's reputation as a navigator is very high; Nansen thinks he may succeed, and so does Dr. Dawson.

A CORRESPONDENT in Lima sends the following note, furnished by the writer:

In their reply to the pupils of the Italian schools, the inmates of the Lima Orphan Asylum express themselves in these words: "We have received the news of a terrible disaster at Galveston. Such is life; one moment we enjoy pleasure and another we suffer grief. Send to this distressed population the golden urn which, with Christian intention, was donated to us. We send it with the permission of the Director of the Benevolent Institute as a contribution to the funds for the aid of the sufferers by the Galveston disaster. We have nothing else at our disposal."

The golden urn referred to was discovered June 14, 1899, in a burying-ground of the old Peruvians in the Monjas section of an estate called Monte Rico Grande, about four miles from Lima. The urn weighs 224 grammes. It is not made of gold, but of a compound similar to the *electrum* of the ancients. It has on two sides human heads, with the large nose of the prehistoric Peruvian race.

G. R. GEPP.

Oct. 31, 1900.

A LETTER to the *Evening Post* under date of December 1, written from Cocoa, Florida, gives some account of the Seminole Indians in the Everglades.

According to the census of 1900, these Indians number 339. The letter says:

That the tribes are doomed to speedy dissolution may be readily believed when one realizes that where two years ago hundreds of acres were cultivated in corn, peas, rice, pumpkins and potatoes, there are now, by actual observation, but two acres. The young bucks devote their time to trapping and hunting, and at the near-by stores of the whites exchange hides and fresh game for the necessities formerly produced by them on their own ground. . . .

The Indians of Florida have persistently refused to occupy any certain locality that has ever been selected for them by either the United States or the State Government. . . . These 339 Indians are divided into five tribes or "families," all under one "big chief," who has in each tribe a representative or sub-chief. These "families" are scattered over the State in several localities, and from this fact probably arose the confusion as to their numbers. They are generally friendly with the whites. The younger men answer questions promptly in fair English; the older ones speak little or no English. Men predominate among them, forming almost two-thirds of the entire number. Among them are many modern conveniences of civilized life—sewing machines, cooking stoves, mirrors; and plenty of table furnishings—plates, cups and saucers, and knives and forks. The men wear a queue, coiled on top of the head under the turban, after the manner of the Chinese; the woman "bangs" her hair across the front and coils the rest on the top of her head also. Around her neck she wears as many strings of beads as she can carry, and strung across her breast are hammered silver coins representing the wealth of her father or her husband. The children are generally naked until about twelve years old, when the girls don a dress and the boys a breech-cloth. All are barefoot except the men, who generally wear deerskin moccasins.

M. HENRYK ARCTOWSKI, a member of the *Belgica* expedition, sketches, in the review *Ciel et Terre*, of November 1, a plan for international co-operation with the Antarctic expeditions of 1901.

These are the English and the German, and the Argentine expedition to the South Shetlands, with observers stationed on Staten Island. There is yet time, he says, to make the year 1902 a year of international observations in the Southern Hemisphere by establishing a polygon of meteorological stations, comprising the following points:

Punta-Arenas, Staten Island, Cape Pillar, and one of the Diego Ramirez islands, southwest of Cape Horn; the Falkland Islands, South Georgia and South Shetland, and one or two points on the lands discovered by the *Belgica*.

Such a network of observations would furnish a thorough knowledge of the meteorology of all that part of the Antarctic and form a most important contribution to the study of the atmospherical circulation.

MR. EDWIN SWIFT BALCH, of Philadelphia, sends this note:

ICEBERGS IN GLACIER BAY.—On the 14th of July, 1900, I visited Glacier Bay, Alaska, on the steamer *Queen*. At a distance of about twenty kilometres from Muir Glacier we found a line of icebergs, some twenty to thirty metres wide, extending completely across the bay. The steamer went through this barrier very slowly, gradually pushing the bergs aside. Beyond this the bay was studded with icebergs, among which the *Queen* took a more or less zigzag course up to within about seven kilometres from the snout of Muir Glacier, where a barrier of icebergs stretched from shore to shore across the bay and extended all the way up to the glacier. These bergs were not floe-ice at all, but genuine glacier bergs. Many of them were good-sized ones, rising certainly six or eight metres above the water. On some of them there were boulders, on many there was moraine dirt, on others there was snow, and in some the glacier crevasses remained, showing the blue and green colors of such crevasses. In some cases the bergs had evidently turned over in the water. A noticeable feature was a projecting shelf of ice at the surface of the water, showing that the ice had melted away fastest underneath. The icebergs are said to be due to an earthquake, in the fall of 1899, fracturing a portion of the snout of Muir Glacier; but, as far as could be seen through marine glasses, the glacier was unaffected by the loss of all this ice. The scene was Arctic in character and, with the peaks of Fairweather and Crillon occasionally peeping out through the clouds at a height of over 4,500 metres, was a grand sight. It may be worth noting that the Crillon-Fairweather range is unexplored, and that it offers to climbers the finest array of unascended summits in America.

THE ROYAL GEOGRAPHICAL SOCIETY OF AUSTRALASIA, QUEENSLAND, will award the Thompson Foundation Medal (in gold) to the author of the best original paper (to be sent in not later than the 15th of June, 1902), on The Pastoral Industry of Australia, past, present, and probable future.

The competition is open to Members and Non-Members of the Society alike, whether residing in Australasia or elsewhere. No award will be made for a compilation.

All competitive communications for the Medal should be written on one side of the paper only, with marginal space on the left-hand side thereof. Instead of the writer's name each paper must be identified by a motto. A sealed envelope with such motto written outside, and the writer's name and address inside, should accompany each paper.

The successful papers will be published in the Journal of the Society, fifty reprint copies of each being supplied to the author, free.

All communications must be written in the English language, and will become the property of the Society.

Papers may be illustrated by maps, diagrams and pictures.

All communications should be addressed to the Hon. Secretary of the Society.

HUGH M. NELSON, President.
J. P. THOMPSON, Hon. Secretary.

THE SOCIETY'S ROOMS, 102 Elizabeth Street,
Brisbane, Queensland, October 2nd, 1900.

THE SOCIÉTÉ KHÉDIVIALE DE GÉOGRAPHIE celebrated, on the 11th of December, the twenty-fifth anniversary of its foundation. The Société has had a remarkable career, and it deserves the congratulations of all who are interested in geography.

ACCESSIONS TO THE LIBRARY.

NOVEMBER–DECEMBER, 1900.

BY PURCHASE.

Geographisches Jahrbuch, Band XXIII, 1te Hälfte, Gotha, 1900, 8vo; Cabot Bibliography, with Introductory Essay, etc., by George Parker Winship, London, 1900, 8vo; North End and West Side of City of New York: Official Maps of the Commissioners of Central Park, New York, 1868, 2 sheets in case; Prince Henry the Navigator, by C. Raymond Beazley, New York, 1895, 8vo; From the Levant, the Black Sea and the Danube, by R. Arthur Arnold, 2 vols., London, 1868, 8vo; Early History of Southampton, Long Island, N. Y., by G. R. Howell, New York, 1866, 8vo; Historic Chateaux, by A. B. Cochrane, London, 1877, 8vo; In the Volcanic Eifel, by K. S. and G. S. Macquoid, New York, 1896, 8vo; A History of British India, by Sir W. W. Hunter, *Vol. 2*, London, 1900, 8vo; Australasia (British Empire Series, Vol. IV), London, 1900, 8vo; The Problem of Asia, by A. T. Mahan, Boston, 1900, 8vo; In and Around the Grand Canyon, by G. W. James, Boston, 1900, 8vo; Memoirs of a Revolutionist, by P. Kropotkin, Boston, 1899, 8vo; A Book for All Readers, by A. R. Spofford, New York, 1900, 8vo; The Jews of Angevin England, by Joseph Jacobs, New York, 1893, sq. 16mo; China's Only Hope, by Chang Chih-Tung, New York (1900), 12mo; The Great Salt Lake Trail, by H. Inman and W. F. Cody, New York, 1898, 8vo; La France Hors de France, par J.-B. Piolet, S. J., Paris, 1900, 8vo; On the Trail of a Spanish Pioneer, the Diary, etc., of Francisco Garcés, by Elliot Coues, New York, 1900, 2 vols., 8vo; De Paris aux Mines d'Or de l'Australie Occidentale, par O. Chemin, Paris, 1900, 8vo; Tuscan Studies and Sketches, by Leader Scott, New York, 1887, 8vo; Personal Narrative of Two Years' Imprisonment in Burmah, by Henry Gouger, London, 1860, 8vo; Pen and Pencil in Asia Minor, by William Cochran, New York, 1888, 8vo; The Voyage of Captain John Saris to Japan, 1613, edited by Sir E. M. 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TRANSACTIONS OF THE SOCIETY.

A regular meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, November 13, 1900, at 8.30 o'clock, P M.

Vice-President Moore in the chair.

The following persons, recommended by the Council, were elected Fellows:

George Melville Boynton.
Charles Vetter, Jr.
Bertrand F. Bell.
Edwin S. Balch.
Ed. F. Burke.
Emil S. Fischer.
John R. Weeks.

The Chairman introduced the speaker of the evening, Mr. Edward Whymper, who delivered a lecture entitled "Twenty Thousand Feet above the Sea." This was illustrated with stereopticon views.

On motion, the Society adjourned.

A regular meeting of the Society was held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, December 11, 1900, at 8.30 o'clock, P.M.

Vice-President Moore in the chair.

The following persons, recommended by the Council, were elected Fellows:

Gen. Russell Hastings.
Henry Freeman Walker, M.D.
Gardner Wetherbee.
Orrin S. Wood.
Francis H. Leggett.
Howard K. Burras.
Justus L. Bulkley.
Edmund Carleton.
William Ziegler.
Wm. T. Wardwell.
Charles Wehrhane.
F. Gray Blinn, M.D.
Grenville L. Winthrop.
George S. Bowdoin.
John T. Willets.

The Chairman then introduced W. A. P. Martin, D.D., President of the Imperial University, Peking, who addressed the Society on the Siege in Peking; its Causes and Consequences.

A vote of thanks to Dr. Martin was proposed and unanimously adopted.

On motion, the Society adjourned.

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